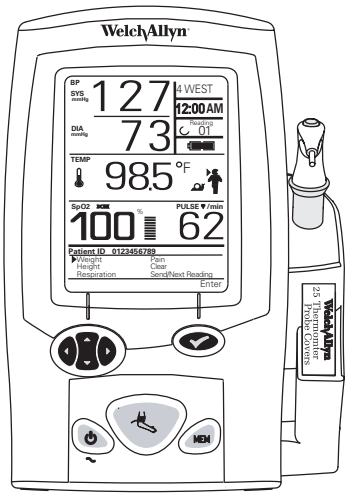
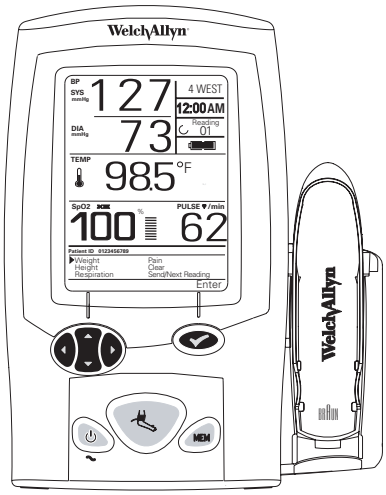
Welch Allyn Spot Vital Signs LXi





Service Manual

Welch Allyn®

Advancing Frontline Care™

Welch Allyn Spot Vital Signs LXi

Service Manual

Welch Allyn®

Advancing Frontline Care™

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1 Safety Summary

Introduction

All users of the Spot Vital Signs LXi must read and understand the safety summary, and all additional specific warnings and cautions located throughout the documentation.

Warnings and Cautions

Familiarize all operating personnel with the general safety information in this summary. Specific warnings and cautions are also found throughout this manual.

General Warnings

A warning statement in this manual identifies a condition or practice, which if not corrected or discontinued immediately, could lead to patient injury, illness, or death.

These warnings pertain to the entire Spot Vital Signs LXi device.

WARNING The information in this manual is a comprehensive guide to the operation of Spot LXi. For best results, read this manual thoroughly before using the device.

WARNING Spot LXi is designed for medical clinician use. Although this manual may illustrate medical spot-check techniques, only a trained clinician who knows how to take and interpret a patient's vital signs should use this device.

WARNING Spot LXi is not intended for use in environments that are without health care practitioner supervision.

WARNING Spot LXi is not intended for continuous monitoring. **Do not leave the device unattended while taking measurements on a patient.**

WARNING To ensure data integrity, save readings and clear the Spot LXi display between patients.

WARNING The Spot LXi is not defibrillator proof.

WARNING Spot LXi is not intended for use during patient transport.

WARNING This device is not suitable for use in the presence of a flammable anesthetic mixture with air or oxygen or nitrous oxide. An explosion may result.

WARNING To ensure patient safety, use only accessories and supplies (i.e., cuffs, hoses, temperature probes, SpO_2 sensors, etc.) recommended for or supplied with Spot LXi. Using unapproved accessories with Spot LXi can affect patient and/or operator safety.

WARNING Take care to prevent water or other fluid from entering any connectors on the device. Should this occur, dry the connectors with warm air. Check the accuracy of all operating functions.

WARNING Every three months, inspect the blood pressure cuff, SpO_2 cable, and other accessories for fraying or other damage. Replace as necessary.

WARNING Do not use Spot LXi on patients who are on heart/lung machines.

WARNING Electric shock hazard. There are no user-serviceable parts inside Spot LXi other than battery replacement (see "Battery Replacement" on page 69). An operator may only perform maintenance procedures specifically described in this manual. For service, refer the device to an Authorized Service Center.

WARNING This device is not intended for hand-held use during operation.

WARNING Do not autoclave.

WARNING This device complies with current required standards for electromagnetic interference and should not present problems to other equipment or be affected by other devices. As a precaution, avoid using this device in close proximity to other equipment.

WARNING Welch Allyn is not responsible for the integrity of any mounting installation. Welch Allyn recommends that the customer contact their Biomedical Engineering Department or maintenance service to ensure professional installation for safety and reliability of any mounting accessory.

WARNING The Spot LXi consists of high-quality precision parts. Protect it from severe impact and shock. A qualified service technician must check any Spot LXi that is dropped or damaged for proper operation prior to further use. Do not use the Spot LXi if you notice any signs of damage. Contact the Welch Allyn Customer Service Department for assistance.

WARNING Do not use an SpO_2 finger clip sensor and a blood pressure cuff simultaneously on the same limb. Doing so may result in inaccurate pulse rate and perfusion readings.

WARNING The USB port is for service only. Do not use this connection for any external equipment connections.

Blood Pressure Warnings

These warnings pertain to the Spot LXi blood pressure feature.

WARNING Spot LXi is not intended to measure BLOOD PRESSURE on neonatal patients. The AAMI SP10:2002 standard defines neonates as children 28 days or less of age if born at term (37 weeks gestation or more); otherwise up to 44 gestational weeks.

WARNING To ensure pediatric blood pressure accuracy and safety, the Child Reusable Two-Piece Blood Pressure Cuff (4500-01), Infant Durable One-Piece Cuff (5082-82-4MQ), and the Infant Disposable One-Piece Cuff (5082-92-4MQ) are the smallest cuffs approved for use with young children and infants. The child's arm must fit within the range markings on the cuff.

WARNING Avoid compression of the blood pressure hose or cuff tubing of Spot LXi. This may cause system errors to occur in the device.

WARNING Patients who are experiencing moderate to severe arrhythmias may give inaccurate blood pressure measurements.

WARNING Spot LXi does not operate effectively on patients who are experiencing convulsions or tremors.

WARNING Use only Welch Allyn blood pressure cuffs and/or hoses. Using other manufacturers' blood pressure cuffs and/or hoses may produce inaccurate blood pressure readings.

WARNING When several blood pressure measurements are taken on the same patient, regularly check the cuff site and extremity for possible ischemia, purpura, and/or neuropathy.

WARNING Do not allow a blood pressure cuff to remain on the patient more than 10 minutes when inflated above 10 mmHg. This may cause patient distress, disturb blood circulation, and contribute to injury of peripheral nerves.

WARNING Do not place the cuff on any extremity that is used for intravenous infusions or any area where circulation is compromised.

WARNING Excessive cuff tightness may cause venous congestion and discoloration of the limb.

WARNING Wrapping the cuff too loosely (preventing proper inflation) may result in errors.

Temperature Warnings

These warnings pertain to the Spot LXi temperature feature.

SureTemp® Plus

These warnings are specific to the SureTemp Plus thermometer option.

WARNING Use only Welch Allyn probe covers. Using other manufacturers' probe covers or no probe cover may produce temperature measurement errors and/or inaccuracy.

WARNING Long-term continuous monitoring beyond three to five minutes is not recommended in any mode.

WARNING Oral/axillary probes (blue ejection button at top of probe) and blue removable probe wells are used for taking oral and axillary temperatures only. Rectal probes (red ejection button) and red removable probe wells are used for taking rectal temperatures only. Use of the probe at the wrong site will result in temperature errors. Use of the incorrect removable probe well could result in patient cross-contamination.

WARNING The thermometer connectors and probe are not waterproof. Do not immerse or drip fluids on these items. Should this occur, dry the connectors and probe with warm air. Check all functions for proper operation and accuracy.

WARNING Do not take an axillary temperature through patient's clothing. Direct probe cover to skin contact is required.

WARNING Do not autoclave.

WARNING Use Welch Allyn single-use disposable probe covers to limit patient cross-contamination.

WARNING Incorrect insertion of probe can cause bowel perforation.

WARNING Washing hands greatly reduces the risk of cross-contamination and nosocomial infection.

WARNING To ensure optimal accuracy, always confirm that the correct mode is selected.

Braun Thermoscan PRO 4000

These warnings are specific to the Braun ThermoScan PRO 4000 thermometer option.

WARNING Keep the probe window clean, dry, and undamaged at all times to ensure accurate measurements. To protect the probe window, always keep the thermometer in the storage cover while transporting or when not in use.

WARNING Only use Braun ThermoScan probe covers with this thermometer. Using other manufacturer's probe covers or no probe cover may produce temperature measurement errors and/or inaccuracies. If the thermometer is used without a probe cover attached, clean the lens (see "Braun ThermoScan PRO 4000 Thermometer" on page 78).

WARNING Do not autoclave.

WARNING The thermometer is not waterproof. Do not immerse or drip fluids on it. Should this occur, dry the thermometer with warm air. Check for proper operation and accuracy.

SpO_2 Warnings

These warnings pertain to the Spot LXi SpO_2 feature.

WARNING Only use Spot LXi with Masimo or Nellcor SpO_2 option with Masimo or Nellcor brand sensors and accessories, respectively. Using the wrong or unapproved sensors or cables may cause improper performance.

WARNING The SpO_2 sensor and extension cables are intended for use only for pulse oximetry measurements. Do not attempt to connect these cables to a PC or any similar device.

WARNING Before using, carefully read the sensor Directions for Use, including all warnings, cautions, and instructions.

WARNING Do not use a damaged sensor or pulse oximetry cable or a sensor with exposed optical components.

WARNING Incorrect application or a long duration of use of an SpO_2 sensor may cause tissue damage. Inspect the sensor site periodically as directed in the sensor's Directions for Use.

WARNING Certain ambient environmental conditions, sensor application errors, and certain patient conditions may affect SpO_2 readings and pulse signal.

WARNING Do not immerse the sensor or patient cables in water, solvents, or cleaning solutions (the sensors and connections are not waterproof). Do not use irradiation, steam, or ethylene oxide for sterilization.

WARNING The SpO_2 in the Spot LXi device is not intended for use as an apnea monitor.

WARNING Consider the SpO_2 an early warning device. As a trend toward patient deoxygenation is indicated, use laboratory instruments to analyze blood samples to completely understand the patient's condition.

WARNING Tissue damage can be caused by incorrect application or duration of use of a Nellcor OxiMax sensor. Inspect the sensor site as directed in the sensor Directions for Use.

WARNING Do not use the sensors during magnetic resonance imaging (MRI) scanning. Induced current could potentially cause burns. The MS board pulse oximeter may affect the MRI image, and the MRI unit may affect the accuracy of the oximetry measurements.

WARNING Carefully route patient cabling to reduce the possibility of patient entanglement or strangulation.

WARNING Failure to cover the Nellcor OxiMax sensor site with opaque material in high ambient light conditions may result in inaccurate measurements.

General Cautions

A caution statement in this manual identifies a condition or practice, which if not corrected or discontinued immediately, could lead to equipment failure, equipment damage, or data loss.

These cautions pertain to the entire Spot Vital Signs LXi device.

Caution If the accuracy of any measurement is in question, check the patient's vital sign(s) with an alternate method and then check to verify the device is functioning properly.

Caution Place the device on a secure surface or use one of the optional mounting accessories.

Caution Do not place fluids on or near the device.

Caution It is recommended that the device is used within stated operating temperature ranges (see "Environmental" on page 73). The device will not meet its performance specifications if used outside these temperatures ranges.

Caution For proper patient electrical isolation, use only a Welch Allyn power supply (4500-101A) to charge Spot LXi and its attached peripheral devices. Do not use an external charger while the printer is attached to Spot LXi.

Caution Always unplug the AC power transformer from the outlet before moving the mobile stand to a new location.

Caution The basket has a three-pound weight limit. Take care not to exceed this limit.

Caution Only use a 9V battery with the Health-o-Meter scale. Remove and discard the wall mounted power supply.

Caution When using the Health-o-Meter scale, remove the two hex nuts on the RS-232 cable, as supplied, before screwing the cable into the scale base.

Blood Pressure Cautions

These cautions pertain to the Spot LXi blood pressure feature.

Caution Minimize extremity and cuff motion during blood pressure readings.

Caution If the blood pressure cuff is not at heart level, note the difference in reading due to the hydrostatic effect. Add the value of 1.80 mmHg (.2 kPa) to the displayed reading for every inch (2.5 cm) above heart level. Subtract the value of 1.80 mmHg (.2 kPa) from the displayed reading for every inch (2.5 cm) below heart level.

Caution Proper blood pressure cuff size and placement is essential to the accuracy of the blood pressure determination. See Reusable Two-Piece Cuff Measurements or Durable One-Piece Cuff Measurements of the Directions for Use for sizing information.

Caution The position and physiologic condition of the subject can affect a blood pressure reading.

Temperature Cautions

These cautions pertain to the Spot LXi temperature feature.

Caution The SureTemp Plus feature only operates with the probe well in place.

Caution Do not use alkaline batteries in the Braun ThermoScan PRO 4000.

Caution Biting the probe tip may result in damage to the probe.

SpO_2 Cautions

These cautions pertain to the Spot LXi SpO_2 feature.

Caution The pulse oximeter is calibrated to determine the percentage of arterial oxygen saturation of functional hemoglobin. Significant levels of dysfunctional hemoglobin such as carboxyhemoglobin or methemoglobin may affect the accuracy of the measurement.

Caution Some sensors may not be appropriate for a particular patient. If at least 10 seconds of perfusion pulses cannot be observed for a given sensor, change sensor location or sensor type for perfusion to resume.

Caution Physiological conditions, medical procedures, or external agents that may interfere with the pulse oximeter's ability to detect and display measurements include dysfunctional hemoglobin, arterial dyes, low perfusion, dark pigment, and externally applied coloring agents such as nail polish, dye, or pigmented cream.

Caution When selecting a sensor, consider the patient's weight and activity level, the adequacy of perfusion, the available sensor sites, the need for sterility, and the anticipated duration of monitoring.

Electrostatic Discharge (ESD)

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS.

Electrostatic discharge is a sudden current flowing from a charged object to another object or to ground. Electrostatic charges can accomulate on common items such as foam drinking cups, cellophane tape, synthetic clothing, untreated foam packaging material, and untreated plastic bags and work folders, to name only a few.

Electronic components and assemblies, if not properly protected against ESD, can be permanently damaged or destroyed when near or in contact with electrostatically charged objects. When you handle components or assemblies that are not in protective bags and you are not sure whether they are static-sensitive, assum that they are static-sensitive and handle them accordingly.

- Perform all service procedures in a static-protected environment. Always use techniques and equipment designed to protect personnel and equipment from electrostatic discharge.
- Remove static-sensitive components and assemblies from their static-shielding bags only at static-safe workstations - a properly grounded table and grounded floor mat - and only when you are wearing a grounded wrist strap (with a resistor of at least 1 megohm in series) or other grounding device.
- Use only grounded tools when inserting, adjusting, or removing static-sensitive components and assemblies.
- Remove or insert static-sensitive components and assemblies only with monitor power turned off.
- Insert and seal static-sensitive components and assemblies into their original static-shielding bags before removing them from static-protected areas.

Always test your ground strap, bench mat, conductive work surface, and ground cord before removing components and assemblies fromtheir protective bags and before beginning any disassembly or assembly procedures.

Symbols

The following symbols are associated with the Spot Vital Signs LXi.

Safety Symbols

Identifies information within the manual to avoid injury.

Caution: consult accompanying documents

Handle with Care

Storage Humidity

Class II Equipment

Type BF Equipment

Do not dispose of this product as unsorted municipal waste. Prepare this product for reuse or separate collection as specified by Directive 2002/96/EC of the European Parliament and the Council of the European Union on Waste Electronic and Electrical Equipment (WEEE). If this product is contaminated, this directive does not apply.

For more specific disposal information, see www.welchallyn.com/weee, or contact Welch Allyn Customer Service at +44 207 365 6780.

Mode of Operation: Continuous

Identifies information within the manual to avoid equipment failure.

Internally Powered, Lead Acid Battery

Transport Temperature

Recycle

IPXØ

Equipment is not protected against the ingress of liquid.

On/Off

Non-ionizing radiation (RF transmitter)

Button Symbols

Navigation Buttons

Select

Blood Pressure

Memory

Power On/Off

Connection Symbols

USB Connection

Serial Port Connection

Agency Symbols

CERTIFIED TO:
CAN/CSA STD C22.2 NO. 601.1

CONFORMS TO:
UL STD 60601-1

IEC 60601-1

EMC Framework of Australia

The CE mark on this product indicates that it has been tested to and conforms with the provisions noted within the 93/42/EEC Medical Device Directive.

European Regulatory Manager
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Navan Business Park
Dublin Road
Navan, County Meath, Republic of Ireland
Tel.: 353 46 90 67700
Fax: 353 46 90 67756

2 Overview

Purpose and Scope

The Spot Vital Signs LXi Service Manual is intended as a reference for maintenance and repair to the field replaceable unit (FRU) level and are listed on page 65. This manual provides the technical qualified service person with troubleshooting information, repair procedures, and calibration and performance verification instructions. A technical overview of the Spot LXi subsystems is provided as an introduction to the device's circuitry and pneumatics.

This manual is intended for the technical qualified service person. Service training classes on Welch Allyn's products are available. Contact Welch Allyn Technical Service for information.

Other Applicable Documents

The Spot Vital Signs LXi Directions for Use manual is also available. Refer to this document for information other than maintenance and repair.

Welch Allyn 9600 Plus Calibration Tester Directions for Use - for all models.

Braun ThermoScan PRO 4000 User's Guide - for models 450E0, 45NE0, 45ME0.

Masimo Directions for Use - for models 45MT0, 45ME0.

Nellcor Directions for Use - for models 45NT0, 45NE0.

Contents Checklist

Unpack the Spot LXi and any applicable accessories and then inspect for missing items. Retain the shipping materials in the event of shipping damage or for return, if necessary, to Welch Allyn for repair or warranty service. Report any signs of shipping damage to the carrier. Report any missing or damaged items to the Welch Allyn Service Center near you.

All Spot LXi devices include the following components:

Spot LXi Device. This device automatically measures and displays blood pressure, pulse rate, and temperature.

Directions for Use Manual. Read this manual thoroughly before using Spot LXi. Save this manual for reference.

Warranty Card. This card validates the Spot LXi warranty. Fill out the warranty card and mail it today.

Blood Pressure Cuff. One cuff with connectors. Other size cuffs are available separately.

Blood Pressure Hose. Latex-free pressure hose with connectors to attach various sizes of blood pressure cuffs to the Spot LXi.

AC Power Transformer and Cord Assembly. Provides power to the Spot LXi and charges the internal battery.

Quick Reference Card. Attach this quick operating guide to the device handle, mobile stand, or wall mount.

Possible Attachments

Spot LXi may include the following items based on the model and accessories purchased:

SureTemp Plus Temperature Probe, Well, and Covers. One oral temperature probe (blue ejection button and well) and one box of 25 single-use, disposable probe covers.

Braun ThermoScan PRO 4000 Thermometer and Covers. One ear thermometer; one box of 20 single-use, disposable probe covers; one rechargeable battery pack; and one lock release pin.

Wireless Radio and Mounting Bracket. Attach these items to the back of the mobile stand or wall mount basket.

Barcode Scanner and Mounting Bracket. Attach these items on the basket of the mobile stand or wall mount.

Pulse Oximetry (SpO_2). The finger clip SpO_2 sensor and extension cable are for use with adult and pediatric patients. Other sensors are available separately.

Printer. Attach to the basket of the mobile stand or wall mount. The printer comes with a roll of paper. Rolls of paper and labels are available separately.

Service

Caution Unauthorized repairs will void the warranty.

A Welch Allyn Service Center must perform all repairs on products under warranty. Qualified electronics personnel or a Welch Allyn Service Center should repair products out of warranty.

Technical Assistance

If you have an equipment problem that you cannot resolve, call the Welch Allyn Service Center nearest you for assistance. Technical service telephone support is available on normal business days.

If you are advised to return a product to Welch Allyn for repair or routine maintenance, schedule the repair with the service center nearest you.

Before returning a product for repair, you must obtain authorization from Welch Allyn. Service personnel will give you a Service Notification number. Please note this number on the outside of your shipping box. Returns without a Service Notification number will not be accepted for delivery.

Field Replacement Units

Included with the Service Manual is a complete list of field replacement units. Order spare parts from your local Welch Allyn Service Center.

Service Loaners

Service loaners are provided, on request, if a Welch Allyn Service Center provides repair service. Loaners for products repaired while under the original warranty, or while under service contract, are provided free of charge and are shipped within 48 hours of notification of need.

For service repairs outside of warranty or contract, loaners are available for a nominal charge and shipment is subject to availability. Loaners are shipped pre-paid; however, this charge is added to the service charges.

Service Intervals

Verify Spot Vital Signs LXi on an annual basis for blood pressure, temperature, and SpO_2 accuracy.

Spot Vital Signs LXi Configurations

Table 1. Available Versions of Spot Vital Signs LXi

REF	Description
450T0	Blood Pressure with SureTemp Plus Thermometer
450E0	Blood Pressure with Braun ThermoScan PRO 4000 Thermometer
45MT0	Blood Pressure with Masimo SpO_2 and SureTemp Plus Thermometer
45ME0	Blood Pressure with Masimo SpO_2 and Braun ThermoScan PRO 4000 Thermometer
45NT0	Blood Pressure with Nellcor SpO_2 and SureTemp Plus Thermometer
45NE0	Blood Pressure with Nellcor SpO_2 and Braun ThermoScan PRO 4000 Thermometer

Controls

Figure 1. Spot LXi Front Panel with SureTemp Plus Thermometer

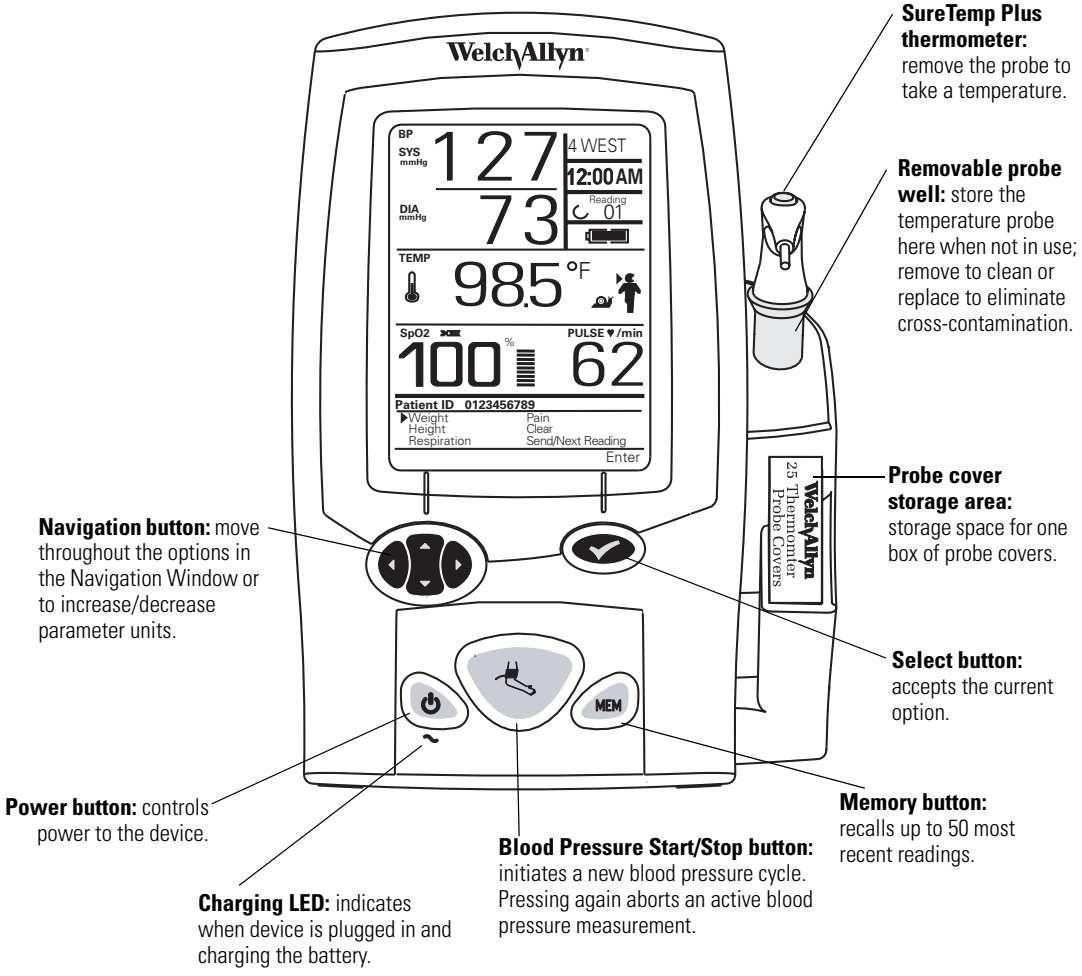
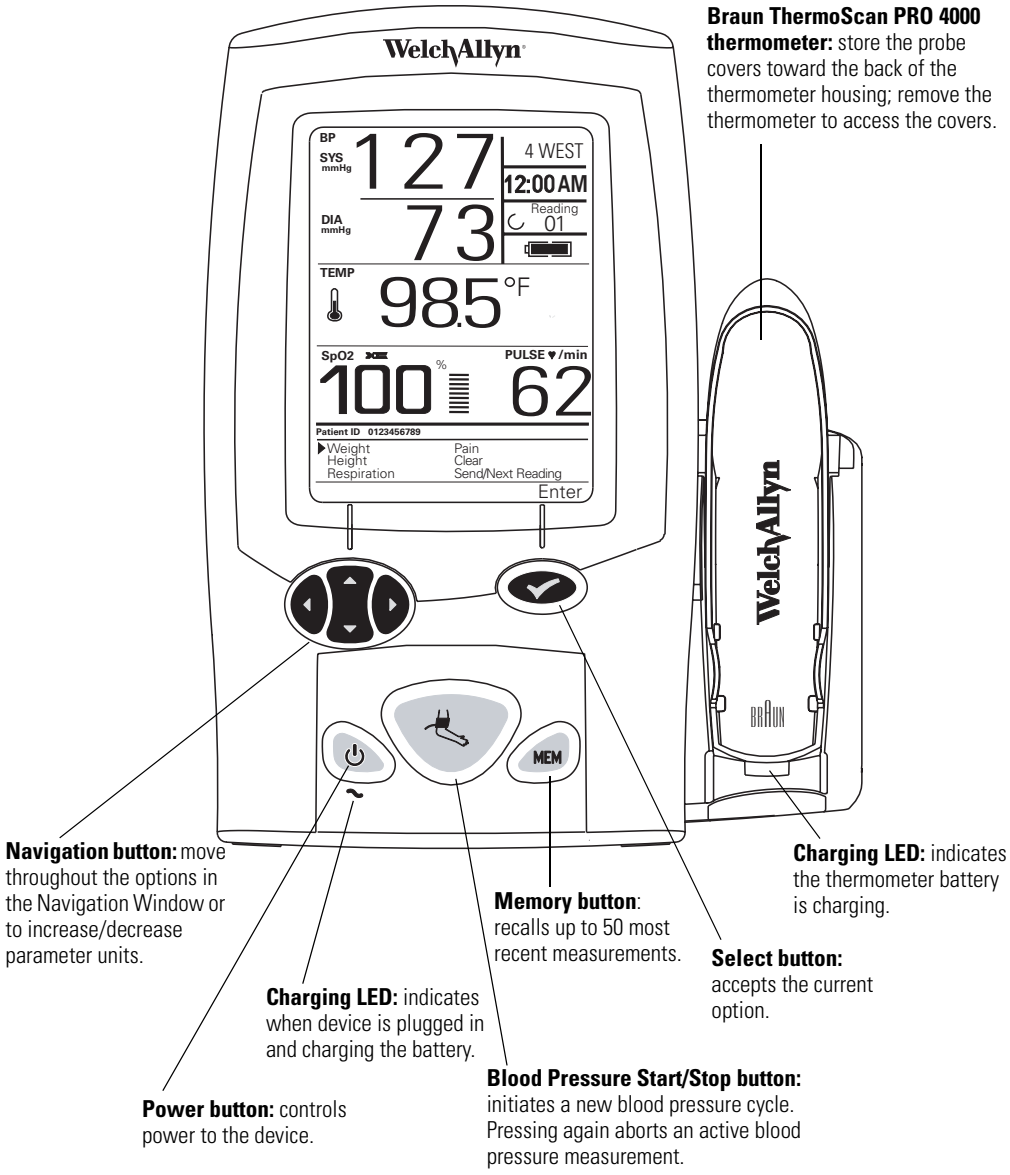

Welch Allyn
BP
SYS mmHg
127
4 WEST
12:00 AM
DIA mmHg
73
Reading 01
TEMP
98.5 °F
SpO2
%
PULSE ♥/min
100
62
Patient ID 0123456789
Weight
Height
Respiration
Pain
Clear
Send/Next Reading
Enter
MEM
25 Thermometer Probe Covers
SureTemp Plus thermometer: remove the probe to take a temperature.
Removable probe well: store the temperature probe here when not in use; remove to clean or replace to eliminate cross-contamination.
Probe cover storage area: storage space for one box of probe covers.
Navigation button: move throughout the options in the Navigation Window or to increase/decrease parameter units.
Select button: accepts the current option.
Power button: controls power to the device.
Memory button: recalls up to 50 most recent readings.
Blood Pressure Start/Stop button: initiates a new blood pressure cycle. Pressing again aborts an active blood pressure measurement.
Charging LED: indicates when device is plugged in and charging the battery.

Figure 2. Spot LXi Front Panel with Braun ThermoScan PRO 4000 Thermometer


Welch Allyn
BP
SYS mmHg
127
4 WEST
12:00 AM
DIA mmHg
73
Reading 01
TEMP
98.5 °F
SpO2
100 %
PULSE ♥/min
62
Patient ID 0123456789
Weight
Height
Respiration
Pain
Clear
Send/Next Reading
Enter
MEM
Braun ThermoScan PRO 4000 thermometer: store the probe covers toward the back of the thermometer housing; remove the thermometer to access the covers.
Navigation button: move throughout the options in the Navigation Window or to increase/decrease parameter units.
Charging LED: indicates when device is plugged in and charging the battery.
Power button: controls power to the device.
Memory button: recalls up to 50 most recent measurements.
Blood Pressure Start/Stop button: initiates a new blood pressure cycle. Pressing again aborts an active blood pressure measurement.
Select button: accepts the current option.
Charging LED: indicates the thermometer battery is charging.

Display Window

Note Before using Spot LXi for the first time, you must program an initial configuration screen.

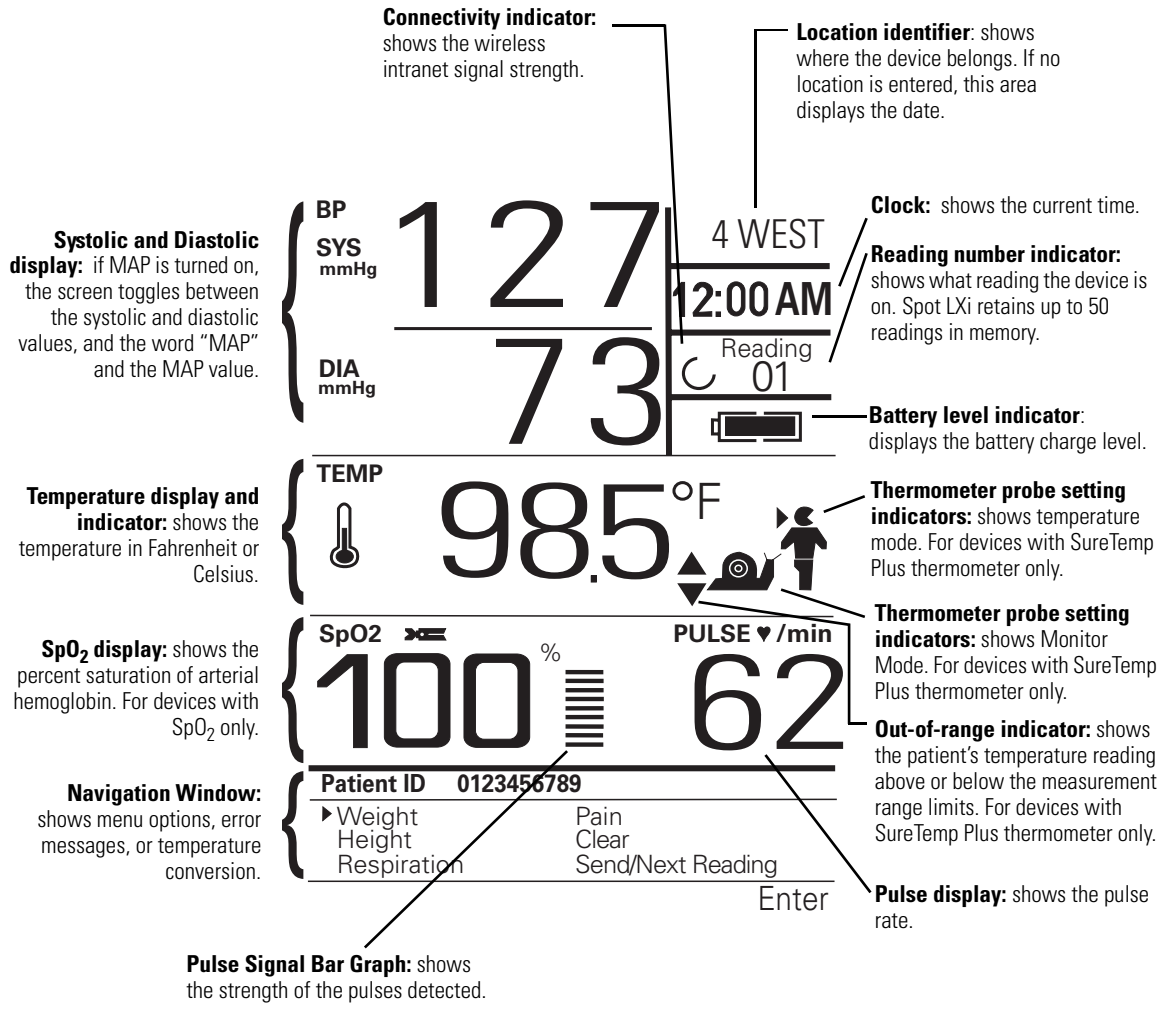
1. Press the **Power** button. The display window shows the initial configuration screen.

Figure 3. Initial Configuration Screen

2. Use the **Select** button to access the options and accept the entries, and use the **Navigation** buttons to move through the menu.
3. The word "Exit" appears at the bottom of the list after you have programmed all items in the menu. You must program all items before you can start to use the device.
4. Scroll to Exit and press the **Select** button to save the entries.

The liquid crystal display (LCD) may indicate any of the following: systolic blood pressure (mmHg or kPa), diastolic blood pressure (mmHg or kPa), MAP (mmHg or kPa), temperature (°F or °C), temperature mode, pulse rate, pulse signal level, SpO_2 percent, department location, date, time, record number, height (in or cm), weight (lb or kg), respiration rate, pain level, connectivity signal strength, and battery charge level.

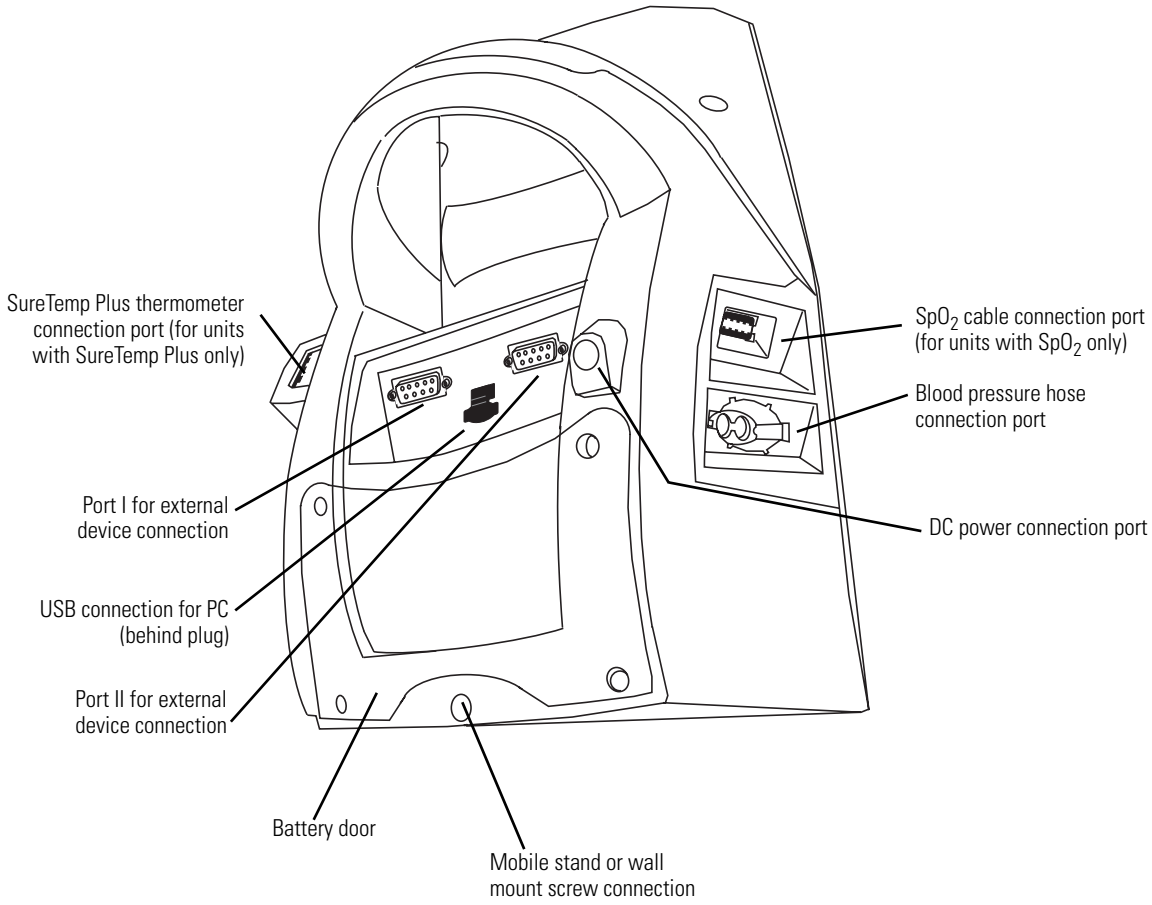
Figure 4. Display Window


Connectivity indicator: shows the wireless intranet signal strength.
Location identifier: shows where the device belongs. If no location is entered, this area displays the date.
Systolic and Diastolic display: if MAP is turned on, the screen toggles between the systolic and diastolic values, and the word "MAP" and the MAP value.
BP
SYS mmHg
127
DIA mmHg
73
4 WEST
12:00 AM
Reading
01
Clock: shows the current time.
Reading number indicator: shows what reading the device is on. Spot LXi retains up to 50 readings in memory.
Battery level indicator: displays the battery charge level.
Temperature display and indicator: shows the temperature in Fahrenheit or Celsius.
TEMP
98.5°F
Thermometer probe setting indicators: shows temperature mode. For devices with SureTemp Plus thermometer only.
Thermometer probe setting indicators: shows Monitor Mode. For devices with SureTemp Plus thermometer only.
SpO2 display: shows the percent saturation of arterial hemoglobin. For devices with SpO2 only.
SpO2
100 %
PULSE ♥ /min
62
Out-of-range indicator: shows the patient's temperature reading above or below the measurement range limits. For devices with SureTemp Plus thermometer only.
Navigation Window: shows menu options, error messages, or temperature conversion.
Patient ID 0123456789
Weight
Height
Respiration
Pain
Clear
Send/Next Reading
Enter
Pulse display: shows the pulse rate.
Pulse Signal Bar Graph: shows the strength of the pulses detected.

Connections

Use the following instructions to connect the blood pressure hose, thermometer probe, and optional attachments to the Spot Vital Signs LXi.

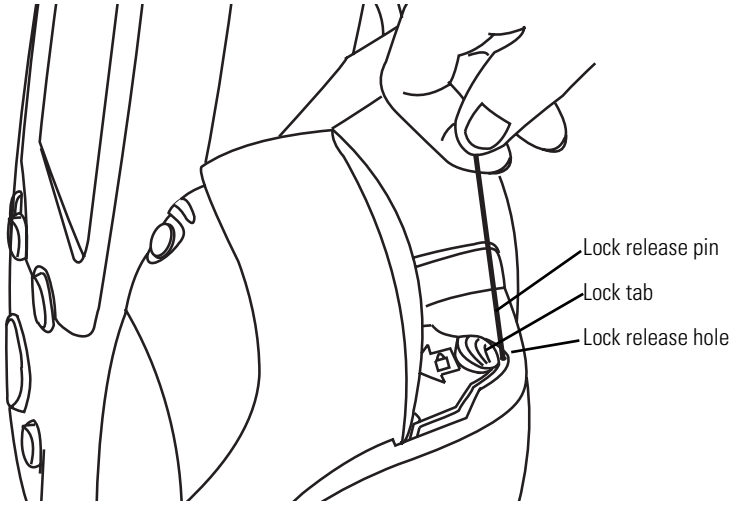
Figure 5. Spot LXi Side and Rear Panel Connections


SureTemp Plus thermometer connection port (for units with SureTemp Plus only)
Port I for external device connection
USB connection for PC (behind plug)
Port II for external device connection
Battery door
Mobile stand or wall mount screw connection
SpO2 cable connection port (for units with SpO2 only)
Blood pressure hose connection port
DC power connection port

Braun ThermoScan PRO 4000 Lock

Press the lock tab toward the Braun ThermoScan PRO 4000 thermometer until it clicks. To release the housing, insert the lock release pin into the lock release hole until the lock tab snaps back.

Figure 6. Spot LXi with Braun ThermoScan PRO 4000 Lock



Blood Pressure Hose and Cuff

Identify and have available the Spot LXi, blood pressure cuff, and the blood pressure hose.

1. Inspect the blood pressure hose; notice that one end has a single, gray connector fitting and the other end has two white fittings.
2. Squeeze the side tabs on the gray connector and completely push the blood pressure hose connector into the blood pressure hose connection port until it clicks into place (see Figure 5 on page 18).
3. Twist the white connectors on the blood pressure hose and cuff connectors together.

Thermometer

Spot LXi is available with either the SureTemp Plus thermometer or the Braun ThermoScan PRO 4000 thermometer.

SureTemp Plus

SureTemp Plus is available with two probes and matching wells; one for oral/axillary temperatures (blue ejection button and probe well) and one for rectal temperatures (red ejection button and probe well).

Caution The SureTemp Plus feature only operates with the probe well in place.

1. Align the probe well with the tabs facing up and down into the round opening of the SureTemp Plus housing on the right side of Spot LXi. Push it into place.

2. Align the temperature probe connector with the SureTemp Plus thermometer connection port on the back of the Spot LXi (see Figure 5 on page 18). You can only insert the connector into the port one way.
3. Press the tab on the connector and push it until it clicks into place.
4. Insert the temperature probe into the probe well.

Braun ThermoScan PRO 4000

Caution Do not use alkaline batteries in the Braun ThermoScan PRO 4000 thermometer.

1. Open the package of rechargable batteries and follow the installation guide provided.
2. Open the box of probe covers as directed on the box and slide the box into the metal guides toward the back of the thermometer housing with the opening at the top and perforation facing forward.
3. Hold the Braun thermometer at a 45° angle then insert the probe and the top of the thermometer into the housing.
4. Lower the bottom portion of the thermometer into the housing until it snaps into place. If you do not properly seat the thermometer, it could fall out of the holder and become damaged.
5. Slide the thermometer housing into the thermometer slot on the right side of the Spot LXi device.
6. Push the lock tab forward to prevent the thermometer housing from falling out of Spot LXi (see Figure 6 on page 19).

   To release the lock, insert the lock release pin into the lock release hole.

SpO_2 Sensor

Spot LXi is available with a wide variety of SpO_2 sensors and ships with a reusable finger clip sensor.

1. Align the shape and pin configuration of the extension cable connector to the SpO_2 cable connection port on the left side of the Spot LXi device.
2. Push the connector firmly into the SpO_2 cable connection port until you hear it click into place (see Figure 5 on page 18).
3. Align the opposite end of the extension cable to the sensor cable connector and firmly push them together.

Note Use only Masimo or Nellcor SpO_2 sensors and accessories with the Spot LXi with Masimo or Nellcor configurations, respectively.

Quick Reference Card

Attach the Quick Reference Card to the Spot LXi handle, mobile stand, or wall mount using the supplied plastic cable tie.

AC Power Transformer

Note To assure proper electrical isolation, replace the AC power transformer/charger using only the Welch Allyn specified part.

The operator can use the Spot LXi with AC or battery power (after charging the battery).

1. Insert the round transformer connector into the AC power connection port on the back of the Spot LXi (see Figure 5 on page 18).
2. Insert the line cord into the line connector on the transformer then plug the power cord on the transformer into the AC main power source to charge the battery.

Battery

Charge the battery for 6 hours before initial use. Charge the device an additional hour if it includes a Braun ThermoScan PRO 4000 thermometer. If there is an external printer, connect the printer to the Spot LXi, enable it in the Internal Configuration Mode (see "Initial Configuration Screen" on page 16 if this is the first time you power on the device and then Table 7 on page 26), and then charge the Spot LXi for an additional 4 hours.

While Spot LXi is charging, the charging LED (~) flashes and the battery level indicator segments on the display continuously sequence. When the battery is fully charged, the charging LED is solid and the battery level indicator is steady with all segments continuously shown on the display.

If the device includes a Braun ThermoScan PRO 4000 thermometer, the charging LED below the thermometer will illuminate orange as it is charging. When the battery is fully charged, the LED will power off.

If the device has an external printer, the charging LED on the printer will flash orange and green when Spot LXi is plugged into the AC main power source.

Note There is no hazard associated with leaving the battery in the device, even if the device is not used for long periods of time.

Standby Mode

The Standby Mode conserves battery power. The device goes into Standby Mode if it is not used for two minutes. Press any button to bring the Spot LXi out of Standby Mode.

3 Functional Overview

This functional verification procedure helps to confirm the proper operation of the Spot Vital Signs LXi and options. This procedure supports the requirements of routine preventative maintenance. It is not necessary to disassemble the Spot LXi to perform this procedure.

For the calibration procedures, see "Calibration" on page 33. If the Spot LXi fails certain functional tests or a circuit board is replaced, the device may require calibration. It is necessary to disassemble the Spot LXi for calibration.

Always perform this functional verification procedure after performing any calibration. This procedure contains additional tests that are not included in calibration procedures.

Self Test

The Spot LXi performs a self-test each time the device is powered on. Press the **Power** button to turn the device on or off. Upon each power up, the display lights up, a beep sounds, and the Spot LXi displays the model and serial numbers. If the internal self-check is successful, the display shows its normal functions (see Figure 4 on page 17) with all values blank, and the device is ready for operation. If the self-check fails, an error code is shown in the Navigation Window (see "Error Codes" on page 37).

Spot LXi automatically powers off when not used for 30 minutes.

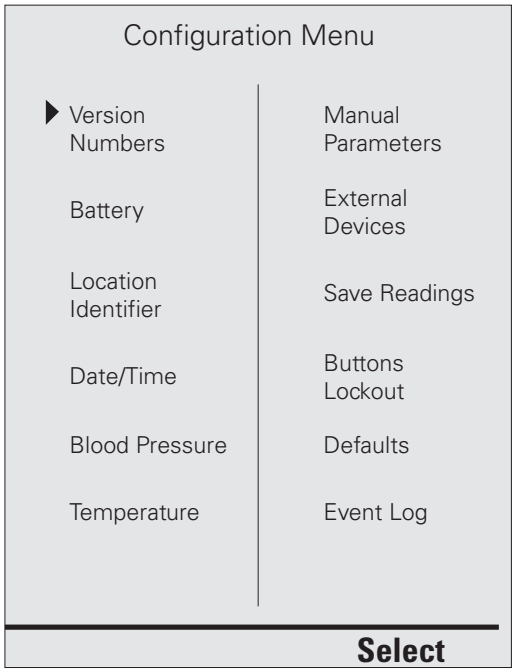
Internal Configuration Mode

You can change several device operating parameters in the Internal Configuration Mode. When changed, these settings become the default power-up settings. You will also see non-changeable device configurations for technical service purposes.

To Enter the Internal Configuration Mode:

1. Turn the Spot LXi off.
2. Press and hold the **Select** and **Power** buttons for 5 seconds. The device enters the Internal Configuration Mode and the Configuration Menu screen appears on the display.

Figure 7. Internal Configuration Mode Menu



3. Use the **Navigation** buttons to move through the menu options and then press the **Select** button to access the options or accept a change. See the following tables for descriptions of the menu options.
4. Press the **Power** button to exit the Internal Configuration Mode.

Table 2. Configuration Menu Options

Setting	Description
Version Numbers*	Displays the software and hardware version numbers in the Spot LXi device.
Battery*	Displays the battery level.
Location Identifier	Allows the entry of the device's location (e.g., the department name). Follow the display prompts and use the **Navigation** and **Select** buttons to enter up to 10 characters.
Date/Time	Changes the date and time formats or updates the actual date and time. See Table 3, "Date/Time Menu Options" for available settings.
Blood Pressure	Changes the blood pressure options. See Table 4, "Blood Pressure Menu Options" for available settings.
Temperature	Changes the temperature options. See Table 5, "Temperature Menu Options" for available settings.
Manual Parameters	Changes the manual parameters defaults. See Table 6, "Manual Parameters Menu Options" for available settings.
External Devices	Enables or disables available external devices. See Table 7, "External Devices Menu Options" for available settings.
Save Readings	Saves the current patient reading at a preselected time interval or upon request. See Table 8, "Save Readings Menu Options" for available settings.
Buttons Lockout	Secures Spot LXi so unauthorized people cannot use the device or access data without enacting the proper key sequence. To override the buttons lockout feature, simultaneously press the **Left Navigation** button and the **Select** button.
Defaults	Allows the user to select the default settings for the device and reset the unit to the default settings. See Table 9, "Change Local Defaults Options" for available settings.
Event Log*	Displays the recent button presses, errors, measurements, measurement sites, battery state changes, and patient reading send events.

* Displayed information only; operator cannot change.

Table 3. Date/Time Menu Options

Setting	Description
Date Format	Displays the date in one of the following styles: • mm/dd/yyyy example: July 16, 2005 = 07/16/2005 • dd/mm/yyyy example: 16 July 2005 = 16/07/2005
Date	Changes the date on the Display Window and in patient readings. If a location is entered (see "Location Identifier " in Table 2, "Configuration Menu Options"), the date will not appear on the Display Window; the location will.
Time Format	Displays the time in one of the following styles: • 12-hour example: 5:00 PM • 24-hour example: 17:00
Time	Changes the time on the Display Window.

Table 4. Blood Pressure Menu Options

Setting	Description
BP Calibration Check	Prepares the Spot LXi for calibration. Only qualified personnel should verify the Spot LXi blood pressure calibration. For more details, see "Blood Pressure Calibration" on page 35.
Blood Pressure Units	mmHg or kPa.
Mean Arterial Pressure (MAP)	On or off.

Table 5. Temperature Menu Options

Setting	Description
Temperature Units	Fahrenheit (°F) or Celsius (°C).
Temperature Mode	SureTemp Plus models only: Oral, Pediatric Axillary, Adult Axillary, and Last Mode. In Last Mode the device takes the next temperature in the mode in which the previous temperature was measured. Rectal Mode is available only when the rectal probe (red ejection button) and probe well are attached.

Table 6. Manual Parameters Menu Options

Setting	Description
Height	On or off.
Height Units	Inches (in) or centimeters (cm).
Height Default	Changes the default patient height displayed in the Navigation Window.
Weight	On or off. Even if weight is enabled here, if weight scale is enabled in the External Devices Menu, you cannot manually enter the weight.
Weight Units	Pounds (lb) or kilograms (kg).
Weight Default	Changes the default patient weight displayed in the Navigation Window.
Respiration	On or off.
Pain Level	On or off.

Table 7. External Devices Menu Options

Setting	Description
Information System	On or off. You must enable this option to send patient readings wired or wirelessly.
Barcode Patient ID	On or off. You must enable this option to send patient readings wirelessly.
Barcode Clinician ID	On or off.
Weight Scale	On or off. Spot LXi can connect to a scale and the weight will appear on the display window (see "Technical Overview" on page 59 for scale details).
Wireless Module	None or DPAC. You must enable DPAC to send patient readings wirelessly. The wireless radio is available as an accessory.
Printer	On or off.
Printer Paper	Plain or labels. Only available if the Printer is enabled.

Table 8. Save Readings Menu Options

Setting	Description
Save Mode	Manual or automatic. If automatic, Spot LXi saves readings at a preselected time interval. For either option, Spot LXi automatically saves the measured parameters into memory before automatically powering off when not used for 30 minutes.
Auto Save Interval	Changes the amount of time before automatically saving the current patient reading. Only available if Automatic Save Mode is enabled.
Reading Full Action	Auto Overwrite, Ask Overwrite, Do not Overwrite. Spot LXi can save 50 patient readings in memory. Upon reaching reading 51, the device may automatically overwrite reading 1, ask the user if he/she wants to overwrite reading 1, or disable the ability to take another reading until at least one reading is erased.

Table 9. Change Local Defaults Options

Setting	Description
Language	English, Dansk, Nederlands, Finnish, Français, Deutsch, Italiano, Norsk, Español, Português, Svenska, or Chinese.
BP Units	mmHg or kPa.
Temperature Units	Fahrenheit (°F) or Celsius (°C).
Height Units	Inches (in) or centimeters (cm).
Weight Units	Pounds (lb) or kilograms (kg).
Date Format	Displays the date in one of the following styles: • mm/dd/yyyy example: July 16, 2005 = 07/16/2005 • dd/mm/yyyy example: 16 July 2005 = 16/07/2005
Time Format	Displays the time in one of the following styles: • 12-hour example: 5:00 PM • 24-hour example: 17:00

Functional Verification

Blood Pressure Functional Check

The calibration check is a simple, yet valuable test to determine that the unit is sensing pressure accurately. Verify the pressure measurement accuracy of the Welch Allyn Spot LXi with an accurate, calibrated pressure meter or sphygmomanometer.

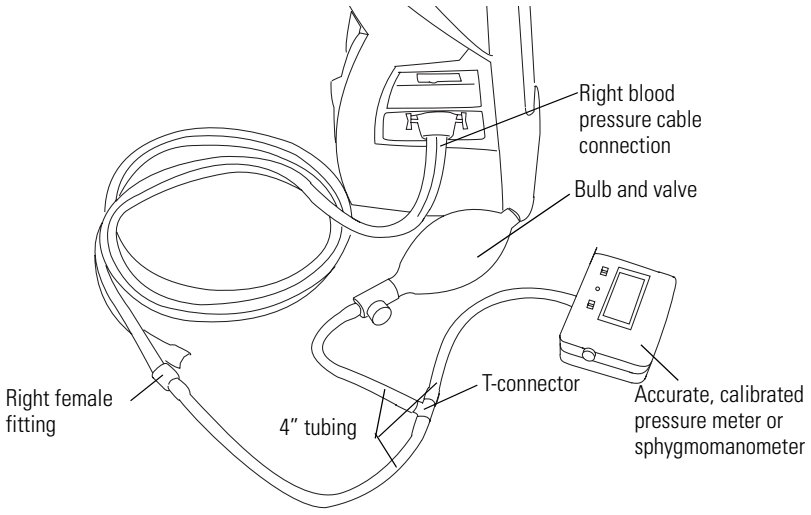
To perform the functional check:

Have the following equipment available:

- Accurate, calibrated pressure meter or sphygmomanometer
- T-connector
- Female fittings (12P524-1) (quantity 2 each)
- 4" tubing with an inside diameter of approximately .250" (quantity 3 each)
- Bulb and valve (5088-01)

1. Disconnect the blood pressure cuff from the blood pressure tubing.
2. Attach two pieces of the 4" tubing to the T-connector. Verify that the tubing is positioned perpendicular to each other.
3. Attach the pressure meter or sphygmomanometer to one of the tubes and the bulb and value assembly to the second tube.
4. Push a female fitting into the third piece of 4" tubing and connect the opposite end of the tubing to the T-connector.
5. Twist the blood pressure tubing fitting that connects to the right blood pressure cable connection port to the female fitting and connect the opposite end of the blood pressure tubing to the blood pressure cable connection port. Verify that all connections are tight.

Figure 8. Blood Pressure Calibration Tubing Connections



6. Enter the Internal Configuration Mode (see "Internal Configuration Mode" on page 24).

7. Press the **Navigation** button to highlight "Blood Pressure" on the display and press the **Select** button.
8. Press the **Navigation** button to highlight "BP Calibration Check" on the display and press the **Select** button.
9. Press the **Select** button to close the valve.
10. Verify that the pressure meter is on and the thumb screw valve is closed. Inflate the device manually to about 250 mmHg.
11. Drop the pressure to 200 mmHg, wait 15 seconds for stabilization, and take a reading.
12. Repeat for 150 mmHg, 50 mmHg, and 0 mmHg (all measuring downscale).

    If the calibration at any point is outside of ±3 mmHg, call Welch Allyn Technical Service for assistance.

Temperature Functional Check

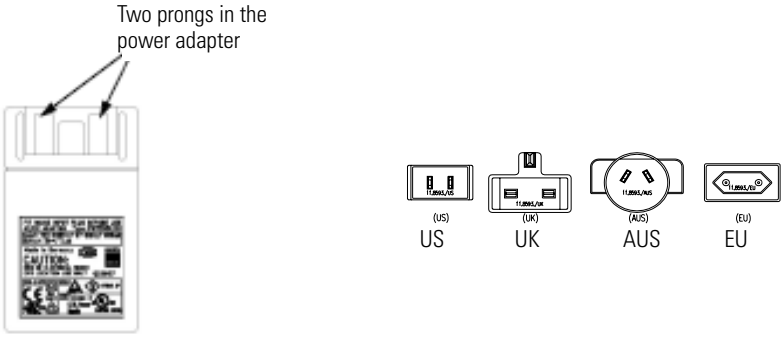
The 9600 Plus Calibration Tester takes approximately 20 minutes to heat to the lowest setting. When testing several thermometers at all three temperatures, it is recommended to test all probes at one Calibration Set Point Temperature before proceeding to the next Calibration Set Point Temperature.

To further expedite testing start at the lowest Calibration Set Point Temperature. The 9600 Plus Calibration Tester does not have an internal fan, this causes a longer cool down time than warm up time.

Refer to the 9600 Plus Calibration Tester Directions for Use manual for specific information regarding the LCD window or the control buttons.

1. Choose the proper mains plug insert and slide it over the two prongs in the power converter.

Figure 9. Power Adapter and Mains Plug Inserts



2. Plug the power adapter into the 9600 Plus Calibration Tester (Figure 9) and the opposite end into a wall outlet.
3. Place the 9600 Plus Calibration Tester on a level surface away from sunlight, drafts, and other sources of heat or cold.
4. Observe the Set Point Mode in the upper left hand corner of the LCD display. If the unit displays a "D", it is in Default Mode and will heat to the lowest Set Point

Temperature. If you do not want to conduct testing at this Set Point Temperature, press and hold the Temperature Selection button to select the desired setting. The temperature display will flash before staying on continuously to indicate the 9600 Plus Calibration Tester has stabilized and is ready for use.

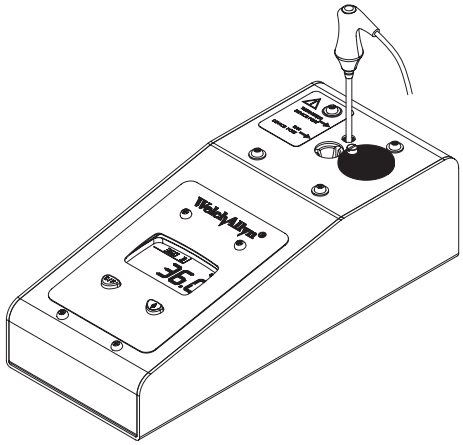
Welch Allyn SureTemp Plus Thermometers

Caution Store thermometers for testing in the same room as the 9600 Plus Calibration Tester for approximately 30 minutes prior to testing to allow for thermal accommodation.

To begin functional verification of the SureTemp Plus thermometer:

1. Remove the probe from the probe well and clean it with either a 70% isopropyl alcohol solution, a 10% chlorine bleach solution, or a non-staining disinfectant. Let the probe air dry. Do not apply a probe cover.
2. Place the thermometer in Monitor Mode, refer to the thermometer's Operator's Manual.
3. Insert the probe into the Thermistor Device Port.

Figure 10. 9600 Plus Calibration Tester with the Welch Allyn SureTemp Plus Thermometer



4. Wait for approximately one minute or until temperature on the thermometer is stable for ten seconds. Compare the thermometer's temperature reading to the 9600 Plus Calibration Set Point Temperature. If the temperatures are within ±0.1° C (±0.2° F), the thermometer is within calibration.
5. Test all available thermometers for calibration verification at the current Calibration Set Point Temperature. Proceed to the next Calibration Set Point Temperature, see "Changing the Calibration Set Point Temperature" on page 32.

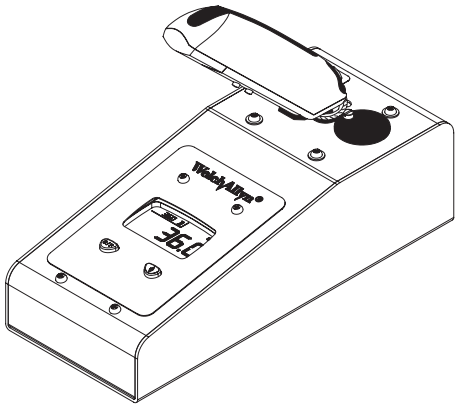
Braun ThermoScan Pro 4000

Caution Store thermometers for testing in the same room as the 9600 Plus Calibration Tester for approximately 30 minutes prior to testing to allow for thermal accommodation.

To begin functional verification of the Braun ThermoScan PRO 4000 thermometer:

1. Clean the probe tip with a cotton swab slightly moistened with isopropyl alcohol, remove excess alcohol with a clean cotton swab, and let air dry for 5 minutes.Do not use any chemical other than alcohol to clean the probe window.
2. Place the Braun ThermoScan Pro 4000 in Calibration Mode using the following steps.
   a. Push and release the I/O MEM button to turn the product on. The display shows symbols and functions. The Braun ThermoScan Pro 4000 performs an automatic self check. After a few seconds you hear a beep and see three dashed lines, a sound symbol, and ° C or ° F on the display.
   b. Push the I/O MEM button again and keep it pressed for the following steps:
      - After approx. 3 seconds the "OFF" symbol flashes on the display (keep pressing the button).
      - When you hear a beep, release the button immediately.
      - The Braun TheromScan Pro 4000 is now in calibration check mode and the display is flashing and showing the "CAL" symbol.
3. Apply a new probe cover. Place the probe firmly into the Ear Device Port.

Figure 11. 9600 Plus Calibration Tester with the Braun ThermoScan Pro 4000



4. Wait approximately three seconds, press the thermometer Start button, and watch for the "Exac Temp" light to flash.
5. Leave the thermometer in the 9600 Plus Calibration Tester until you hear a beep.
6. Remove the Pro 4000 Thermometer from the 9600 Plus Calibration Tester and read the temperature in the thermometer's display. If the temperatures are within ±0.2° C (±0.4° F), the thermometer is within calibration.
7. Wait one full minute before taking another reading with the same thermometer. Repeated measurements in short sequence may cause higher readings.

8. The device will exit CAL mode after four minutes.
9. Test all available thermometers for calibration verification at the current Calibration Set Point Temperature. Proceed to the next Calibration Set Point Temperature, see "Changing the Calibration Set Point Temperature".

Changing the Calibration Set Point Temperature

To scroll from one set point to the next, press and hold the Temperature Selection button until a beep is heard. The newly selected set point appears in the upper left corner of the LCD display. The device's current temperature is displayed, starts to flash, and continues flashing until the cavity reaches the equilibrium at the new set point.

Masimo SpO_2 Functional Check

Use the Masimo Tester to perform to functionally check the Masimo sensors.

1. Orient the Masimo Tester such that the mini-D connector mates with the SpO_2 connector on Spot LXi.
2. Power on Spot LXi and confirm the SpO_2 reading in the Display Window is 81% ± 3% and the pulse reading is 61 bpm ± 1 bpm.
3. Place the thumb and index finger on the gray buttons on either side of the Masimo Tester connector, press the buttons firmly, and gently pull to remove the tester.

There is no way to change the functionality of the SpO_2 module. If the SpO_2 is out of calibration, contact Technical Service.

Nellcor SpO_2 Functional Check

Use a Nellcor-approved SpO_2 simulator (SRC-MAX) to check the SpO_2 functionality.

1. Orient the simulator such that the connector mates with the SpO_2 connector on Spot LXi.
2. Power on Spot LXi and confirm the SpO_2 reading in the Display Window is 81% ± 3% and the pulse reading is 61 bpm ± 1 bpm.
3. Place the thumb and index finger on either side of the simulator connector, press the buttons firmly, and gently pull to remove the simulator.

There is no way to change the functionality of the SpO_2 module. If the SpO_2 is not functioning properly, contact Technical Service.

4 Calibration

This chapter provides procedures to perform all adjustments required to calibrate the Spot LXi to conform to Welch Allyn specifications. Calibration requires qualified personnel to open the device housing.

WARNING Electric shock hazard. There are no user-serviceable parts inside Spot LXi other than battery replacement (see "Battery Replacement" on page 79). An operator may only perform maintenance procedures specifically described in this manual. For service, refer the device to an Authorized Service Center.

Note Always disconnect the sealed lead-acid battery in the Spot Vital Signs LXi before performing any calibration function.

Gather the following tools to have available during the procedures.

Description	Part Number	Qty	Source
Blood Pressure Test Volume Repair Fixture	401028	1	Welch Allyn
Spot LXi Repair Software	401710	1	Welch Allyn
Serivce Manual, Spot LXi	704432	1	Welch Allyn
Tester, Calibration, 9600 Plus	01802-110	1	Welch Allyn
Blood Pressure Y-Tube, No Fittings 1/8 Tube	5082-183	1	Welch Allyn
Pliers		1	Tool/Supply Store
Wire Cutter		1	Tool/Supply Store
Tweezers		1	Tool/Supply Store
#2 Phillips Screwdriver		1	Tool/Supply Store
T10 Torx Driver		1	Tool/Supply Store
Cable Tie Tool		1	Tool/Supply Store
*Setra Pressure Meter	2270-01	1	Setra +1 800 257 3872
*Netech Pressure Meter	2000 in	1	Netech +1 800 547 6557
Masimo SpO2 Tester	1593	1	Masimo +1 800 326 4890
Nellcor SRC-MAX SpO_2 Tester	SRC-MAX	1	Nellcor +1 800 635 5267
Cable, USB A to 5 pin mini		1	Electronics Supply Store
Digital Volt Meter with 4 1/2 Digit Display		2	Electronics Supply Store
Power Supply: 0-20 Vdc adjustable with 0-3A output		1	Electronic Supply Store

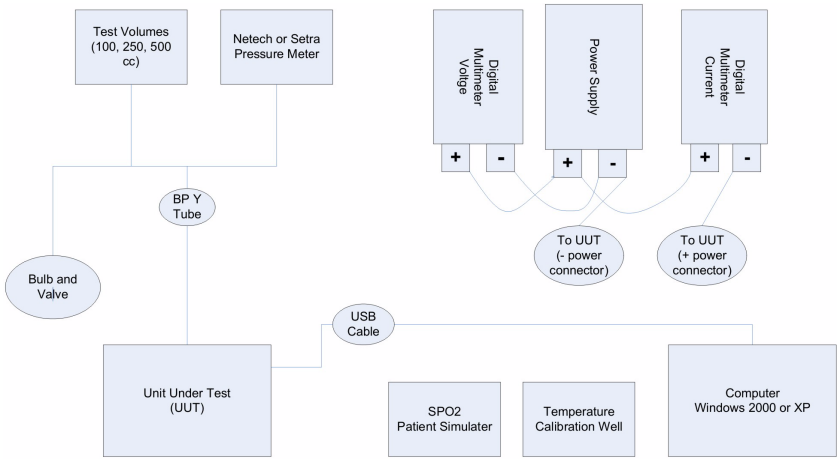
	Description	Part Number	Qty	Source
	IBM compatible computer Windows 2000, XP, NT4		1	

* Only requires one of the pressure meters

Connections

1. Connect the blood pressure pneumatic tubing to the Spot LXi and to the test station.
2. Connect the USB cable to the Spot LXi and the computer.
3. Start the Spot Vital Signs LXi repair software on the computer.
4. Connect the power supply to the Spot LXi.

Figure 12. Connect Diagram



Voltage Calibration

1. Follow the steps in "Connections".
2. Adjust the power supply to 5.5 Vdc ±0.1 Vdc and power on Spot LXi.
3. Select **Calibrate > Voltage** in the repair software. The Spot LXi display window goes blank.
4. Read the voltage on the digital multi-meter (DMM) connected to the power supply.
5. Type the voltage reading in the Actual Voltage field and click the **Calibration** button.
6. Click the **Ok** button to accept the inputs.
7. Click the **Ok** button to answer the question in the text dialog box "Are you sure you want to make changes permanent?"
8. Enter your initials in the Calibration Signature field to complete the voltage calibration.

Blood Pressure Calibration

1. Follow the steps in "Connections" on page 34.
2. Adjust the power supply to 6.5 Vdc (± .25 Vdc).
3. Enter the "Internal Configuration Mode" on page 24. Use the **Navigation** and **Select** buttons to select **Blood Pressure > BP Calibration Check**.
4. Set the test station volume to 500 cc and use the Spot LXi **Navigation** and **Select** buttons to close valve (the Window Display shows "Open Valve").
5. Click the **Calibrate Zero** button.
6. Use the bulb and the calibrated digital pressure meter to manually inflate the device to 200 mmHg and enter the pressure meter reading from Spot LXi in the **Calibration Gain** text field.
7. Click the **Ok** button to accept the inputs.
8. Click the **Ok** button to answer the question in the text dialog box "Are you sure you want to make changes permanent?"
9. Enter your initials in the Calibration Signature field to complete the blood pressure calibration.

Configuration Calibration

1. Follow the steps in "Connections" on page 34.
2. Power on Spot LXi.
3. Select **Unit > Configuration** in the Spot LXi Repair Software.
4. Verify the settings are correct and click the **Ok** button.

   If any of the settings are incorrect click the correct button to change the settings.

   If you update the Spot LXi clock in this menu, the device clock resets itself to match the PC clock. You may manually set the time in the "Internal Configuration Mode" on page 24.

5 Troubleshooting

This chapter provides helpful information in troubleshooting the Spot Vital Signs LXi.

Error Codes

The following tables of error codes provide a quick reference of the descriptions and probable causes of error codes.

Table 10. General Error Codes

Code	Description	Corrective Action
C12	Device outside operating temperature range.	Change ambient temperature.
C13	Low battery level.	Charge battery.
E30	Internal malfunction.	Contact Technical Service.
E31	Internal malfunction.	Contact Technical Service.
E32	Internal malfunction.	Contact Technical Service.
E33	Internal malfunction.	Contact Technical Service.
E38	Date and time not set.	Set date and time (see "Date/Time Menu Options" on page 25)
E42	Internal malfunction.	Contact Technical Service.
E44	Internal malfunction.	Contact Technical Service.
E45	Internal malfunction.	Contact Technical Service.

Table 11. Blood Pressure Error Codes

Code	Description	Corrective Action
C01	Blood pressure reading cancelled by user.	Retake blood pressure reading.
C02	Unable to release cuff pressure.	Check tubing for kinks and connection integrity.
C03	Inflation too quick.	Check tubing and connections.
C04	Air leak.	Check blood pressure cuff and tubing connections.
C05	Unable to determine blood pressure.	Check connections; restrict patient movement.
C06	Unable to determine blood pressure.	Check connections; restrict patient movement.
C07	Internal NIBP error.	Device will power down.
E10	Cuff pressure limits exceeded.	Device will power down.
E11	Cuff pressure duration exceeded.	Device will power down.

Table 11. Blood Pressure Error Codes

Code	Description	Corrective Action
E20	Internal NIBP error.	Device will power down.

Table 12. SureTemp Plus Temperature Error Codes

Code	Description	Corrective Action
C22	Temperature time limit exceeded.	Remove probe from patient.
E0.1	Probe heater error.	Retake reading. If problem persists, replace probe.
E0.2	Thermometer probe or device malfunction.	Replace probe. If problem persists, contact Technical Service.
E0.4	Probe is over temperature.	If problem persists, contact Technical Service.
E0.5	Unable to determine temperature.	Retake reading. If problem persists, replace probe.
E0.6	Probe data error.	Retake reading. If problem persists, replace probe.
E0.7	Broken thermometer probe.	Replace probe.
E0.8	Cannot read the probe's configuration information.	Contact Technical Service.
E0.8	Temperature module data error.	Contact Technical Service to return the device.
E0.8	Cannot read the device's Error Log.	This problem will correct itself. If it persists, contact Technical Service.
E0.9	Broken thermometer probe.	Replace probe.
E4.0	Internal temperature malfunction.	Retake temperature. If problem persists, contact Technical Service.
E4.1	Internal temperature malfunction.	Retake temperature. If problem persists, contact Technical Service.
E4.2	Internal temperature malfunction.	If problem persists, contact Technical Service.
E4.3	Internal temperature malfunction.	If problem persists, contact Technical Service.
E4.4	Temperature malfunction.	Restart device. If problem persists, contact Technical Service.
E4.5	Temperature malfunction.	Restart device. If problem persists, contact Technical Service.
E4.6	Temperature malfunction.	Restart device. If problem persists, contact Technical Service.
E4.7	Cannot initialize thermometer.	If problem persists, contact Technical Service.
E4.8	Thermometer needs to be calibrated.	Contact Technical Service.
E4.9	Probe well missing or installed improperly.	Reinstall probe well.
E5.0	Temperature heater error.	If problem persists, contact Technical Service.
E5.2	Heater failsafe failure.	If problem persists, contact Technical Service.
A^!	Device outside operating temperature range.	Change ambient temperature.
Av!	Device outside operating temperature range.	Change ambient temperature.
b^	Internal temperature malfunction.	Contact Technical Service.
bv	Internal temperature malfunction.	Contact Technical Service.

Table 13. SpO_2 Error Codes

Code	Description	Corrective Action
C8	Faulty SpO_2 sensor.	Replace sensor.
C9	SpO_2 time limit exceeded.	Remove sensor from patient.
E7	Internal SpO_2 error.	Retake reading.

Battery Voltage Check

1. Follow the steps in "Connections" on page 34.
2. Set the power supply to 6.5 Vdc (+0/-0.25 Vdc).
3. Use a DMM to check the battery voltage. If the voltage is less than 6.0 Vdc, charge the battery.

   To charge the battery, place the battery back into the Spot LXi and connect the charger for 8 hours. Let the device sit idle for one day and recheck the battery voltage. If the voltage is below 6.0 Vdc, replace the battery (see "Battery Replacement" on page 79).
4. Power on Spot LXi. If the device does not power on:
   a. Verify the power supply is connected to the device and turned on.
   b. Change the main PCB (see "Disassembly and Repair" on page 45).
   c. Change the display PCB (see "LCD Inverter Ballast Board Disassembly" on page 53).

Window Display Check

Watch the Spot LXi window display during power on and verify the LCD segments light up for one to two seconds before the device goes into its normal operating mode. If the device has any LCD segments that do not light, change the window display (see "LCD Disassembly" on page 53).

Blood Pressure Calibration Check

Perform two or three blood pressure cycles to verify proper cuff inflation/deflation and the readings. If Spot LXi does not inflate or deflate properly perform the following procedure.

1. Open the Spot LXi housing (see "Disassembly and Repair" on page 45).
2. Check Spot LXi for pinched tubing and reroute if necessary. Re-run the blood pressure cycle to confirm the problem is fixed.
3. Power off Spot LXi and enter the Internal Configuration Mode (see "Internal Configuration Mode" on page 24).
4. Use the **Navigation** and **Select** buttons to select **Blood Pressure > BP Calibration Check**.
5. Verify the valve on Spot LXi is closed (the menu choice shows "Open Valve").

6. Use the bulb to manually inflate the device to 250 mmHg and confirm Spot LXi meets the leak test specification (see "Leak Test" on page 81).

Temperature Functional Check

Use the 9600 Plus Caligration Tester to check the SureTemp Plus or Braun ThermoScan PRO 4000 thermometer accuracy (see "Temperature Functional Check" on page 29).

Masimo SpO_2 Functional Check

Use the Masimo Tester to check the functionality of the SpO_2 module of Spot LXi (see "Masimo SpO2 Functional Check" on page 32).

Nellcor SpO_2 Functional Check

Use a Nellcor approved simulator to check the functionality of the SpO_2 module of Spot LXi (see "Nellcor SpO2 Functional Check" on page 32).

Functional Testing Procedures

Perform the functional testing procedures in this section before returning Spot LXi into service.

Verify you are using a calibrated pressure meter with an accuracy of better than ±3 mmHg and that the calibration certificate is traceable to NIST.

Subtract the rated accuracy of the pressure measurement standard from the ±3 mmHg rated accuracy of Spot LXi. This is the pass/fail criteria to determine if the device is within calibration. If the differences between Spot LXi and the pressure measurement standard are within the pass/fail criteria at all specified pressures then the device is within calibration.

1. Follow the steps in "Connections" on page 34.
2. Enter the "Internal Configuration Mode" on page 24. Use the **Navigation** and **Select** buttons to select **Blood Pressure > BP Calibration Check**.
3. Connect to the 500 cc cylinder.
4. Select **Test > Calibration** in the repair software. The dialog box displays the device manometer reading, battery reading, and valve and pump status.
5. Use the **Navigation** and **Select** buttons to select **Blood Pressure > BP Calibration Check**.
6. Verify the valve on Spot LXi is closed (the menu choice shows "Open Valve").
7. Use the hand bulb to verify Spot LXi is within calibration specification at the target pressures of 250±5 mmHg, 150 ±5 mmHg, 50 ±5 mmHg, and 0 mmHg with each reading within ±3 mmHg of the target pressure except for the 0 mmHg reading which is within ±1.0 mmHg.
8. Set the power supply to 5.6 Vdc (+0.3/-0.0 Vdc). Verify the voltage reading meets the specification (see "Voltage Calibration" on page 82).

   After completing this test, return the power suppy to 6.5 Vdc (+0/-0.25 Vdc).

Current Test

1. Follow the steps in "Connections" on page 34.
2. Power off Spot LXi and then power on in normal mode.
3. Select **Test > Current Levels** in the Spot LXi Repair Software. Use the reading from the current meter and record the following current levels:

   a. Sleep State

   b. Patient DAQ Mode

   c. Valve Pump Mode

   The test result is a pass or fail result.
4. Select **Ok** to exit the dialog box.

Noise Levels

1. Follow the steps in "Connections" on page 34.
2. Select **Test > Noise Levels** in the Spot LXi Repair Software and press the **Test** button to retrieve Spot LXi's internal pressure channel noise level. The test result is a pass or fail result.
3. Select **Ok** to exit the dialog box.

Button Test

1. Follow the steps in "Connections" on page 34.
2. Select **Test > Button Test** in the Spot LXi Repair Software and press each button on Spot LXi while verifying that the computer acknowledges each button in the "Test Buttons" display.
3. Select **Ok** to exit the dialog box.

Interface Test

1. Follow the steps in "Connections" on page 34.
2. Select **Test > Display > all on** in the Spot LXi Repair Software to confirm the Window Display shows all of the segments.
3. Select **all off** in the Spot LXi Repair Software to confirm the Window Display clears all of the segments.
4. Select **Test Pattern** in the Spot LXi Repair Software to confirm the Window Display shows a checkerboard pattern.
5. Select **Normal** in the Spot LXi Repair Software to confirm the Window Display returns to the normal display.
6. Select **on** in the backlight Spot LXi Repair Software to confirm the Window Display backlight comes on.

7. Select **off** in the backlight Spot LXi Repair Software to confirm the Window Display backlight goes out.
8. Select **annunciator** to confirm the buzzer of Spot LXi is on. Select **Ok** to exist the test and turn the buzzer off.
9. Select **Ok** to exit the dialog box.

Pneumatic Tests

1. Follow the steps in "Connections" on page 34.
2. Attach the test system to the 100 cc cylinder. Select **Test > Pneumatic > Leak Test**. The software tests for leaks and provides a Pass or Fail indication.
3. Attach the test system to the 500 cc cylinder. Select **Dump Test** . The software tests for the dump speed and provides a Pass or Fail indication.
4. Attach the test system to the 250 cc cylinder. Select **Inflation Test**. The software tests for the inflation time and provides a Pass or Fail indication.
5. Attach the test system to the 100 cc cylinder. Select **Valve Control Test**. The software tests for valve control and provides a Pass or Fail indication.
6. Select **Ok** to exit the dialog box.

Temperature Test

See "Temperature Functional Check" on page 29 to test either the SureTemp Plus or the Braun ThermoScan PRO 4000 thermometer.

Overpressure Test

1. Connect the UUT pneumatic tubing, see Figure 12 on page 34.
2. Disconnect and close the tubing connected to the test volumes.
3. Start a blood pressure cycle and observe the pressure meter. Slowly squeeze the bulb to increase the pressure. Verify the unit displays an E10 error condition when the pressure is between 296 mmHg and 329 mmHg.

Service Work Checklist

Spot Vital Signs

Model Number	Serial Number	BP Cycle Count	Technician	Date

Test	Test Data	Pass/Fail	Test Specification
Unit SW Version			
SPO2 SW Version			
Thermometry SW Version			
Unit Pressure @ 0 mmHg			+/- 1 mmHg
Unit Pressure @ 50 mmHg			+/- 1 mmHg
Unit Pressure @ 150 mmHg			+/- 1.5 mmHg
Unit Pressure @ 250 mmHg			+/- 2.0 mmHg
Test Voltage @ 5.5 V			+/- 0.1 VDC
Current Test – Sleep State			< 0.5 A
Current Test – Patient DAQ			< 1.25 A
Current Test – Valve Pump			< 2.0 A
Noise Level			< 0.05 mmHg
Button Test			Pass/Fail
Interface Test			Pass/Fail
Leak Test			<= 6mmhg in 15 seconds
Dump Test			< 10 Seconds
Inflation Test			< 7 Seconds
Valve Control Test			Pass/Fail
Over Pressure Test			296 to 329 mmHg
SPO2 Sensor - Massimo			81% +/- 3% 61bpm +/- 1bpm
SPO2 Sensor - Nellcor			90% +/- 1% 60bpm +/- 1bpm
Temperature Calibration Suretemp Plus			96.8 +/- 0.2F 105.8 +/- 0.2F
Temperature Calibration Braun Pro 4000			96.8 +/- 0.2F 105.8 +/- 0.2F
Temperature Cal Key Suretemp Plus			97.3 +/- 0.2 F

6 Disassembly and Repair

This chapter provides the instructions for removing and replacing serviceable modules in the Spot Vital Signs LXi.

In general, re-assembly procedures are the reverse order of the disassembly procedures.

WARNING Electric shock hazard. There are no user-serviceable parts inside Spot LXi other than battery replacement (see "Battery Replacement" on page 79). An operator may only perform maintenance procedures specifically described in this manual. For service, refer the device to an Authorized Service Center.

Note Always disconnect the sealed lead-acid battery in the Spot Vital Signs LXi before performing any repair function.

To disassemble Spot LXi:

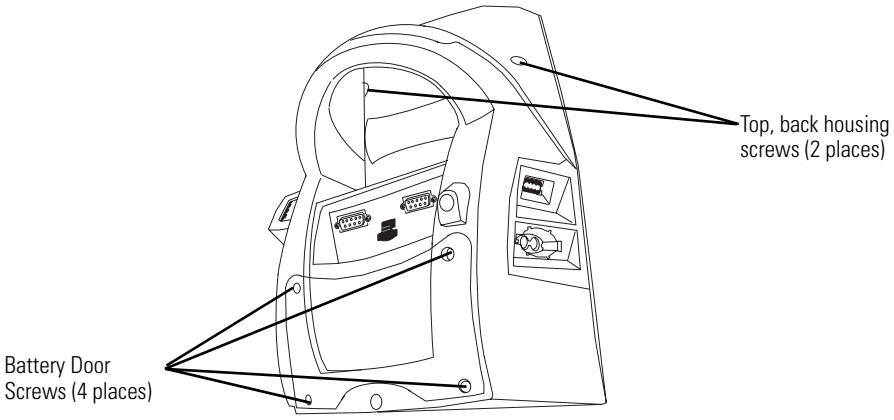
1. Gather the following tools to have available during the procedures.

Description	Part Number	Qty	Source
Blood Pressure Test Volume Repair Fixture	401028	1	Welch Allyn
Spot LXi Repair Software	401710	1	Welch Allyn
Serivce Manual, Spot LXi	704432	1	Welch Allyn
Tester, Calibration, 9600 Plus	01802-110	1	Welch Allyn
Blood Pressure Y-Tube, No Fittings 1/8 Tube	5082-183	1	Welch Allyn
Pliers		1	Tool/Supply Store
Wire Cutter		1	Tool/Supply Store
Tweezers		1	Tool/Supply Store
#2 Phillips Screwdriver		1	Tool/Supply Store
T10 Torx Driver		1	Tool/Supply Store
Cable Tie Tool		1	Tool/Supply Store
*Setra Pressure Meter	2270-01	1	Setra +1 800 257 3872
*Netech Pressure Meter	2000 in	1	Netech +1 800 547 6557
Masimo SpO2 Tester	1593	1	Masimo +1 800 326 4890
Nellcor SRC-MAX SpO_2 Tester	SRC-MAX	1	Nellcor +1 800 635 5267
Cable, USB A to 5 pin mini		1	Electronics Supply Store
Digital Volt Meter with 4 1/2 Digit Display		2	Electronics Supply Store

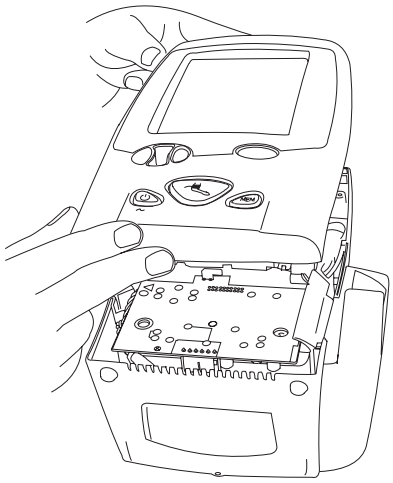
	Description	Part Number	Qty	Source
	Power Supply: 0-20 Vdc adjustable with 0-3A output		1	Electronic Supply Store
	IBM compatible computer Windows 2000, XP, NT4		1	

* Only requires one of the pressure meters

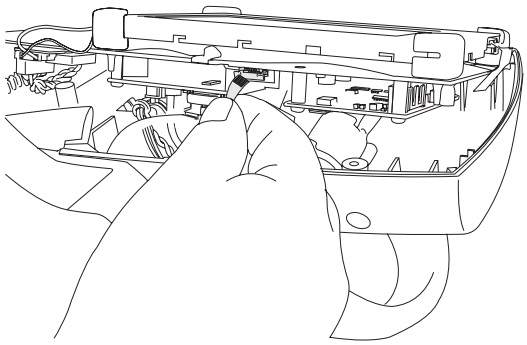
2. Disconnect the power and all accessories from the Spot LXi.
3. Remove the four screws holding the battery door using a phillips-head screwdriver. Remove the battery door to expose the battery.



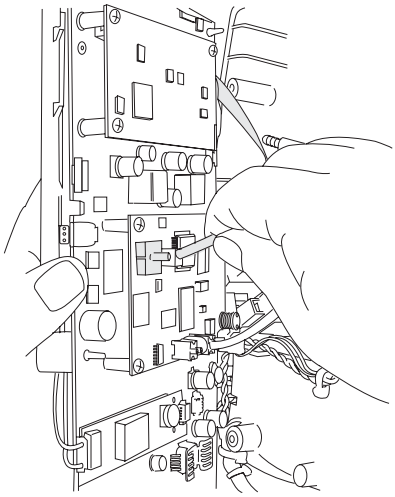
4. Tip the Spot LXi backward and slide the battery out. Disconnect the one-way connector.
5. Remove the two screws inside the battery housing that are identified with arrows molded into the housing and the two screws at the top of the back upper housing.
6. Hold the device together, lay the back housing on the bench, and carefully lift the top housing off.



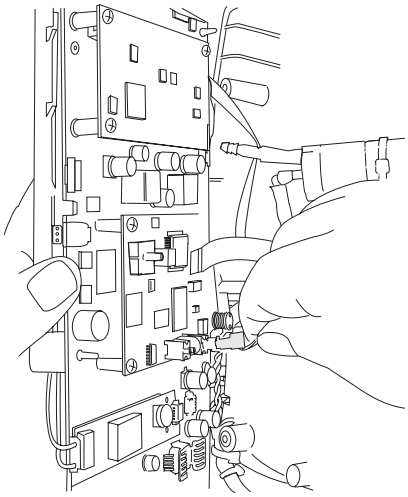
7. Remove the screw and slightly lift the circuit board from the right facing side and disconnect the flex cable.



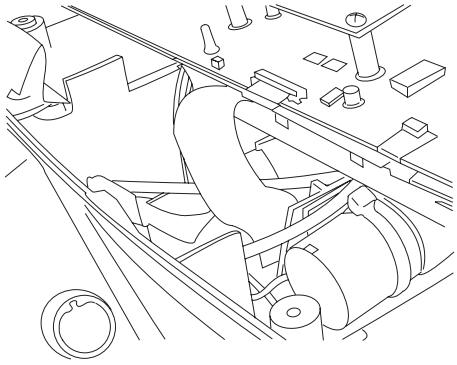
8. Lift and disconnect the wire harnesses and the pneumatic tubing.



9. Disconnect the red electrical connector and the gold ribbon connector.

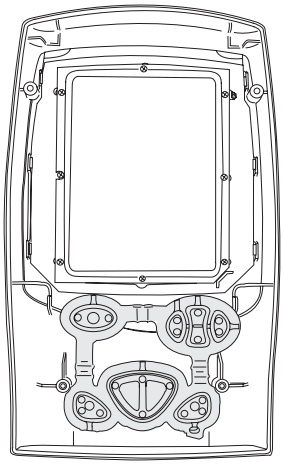


10. Lift the flap on the beige connector to remove the main board.



Key Pad Disassembly

1. Gently pull the button switch array out of the cover.
2. Align and push the new button switch array into place.



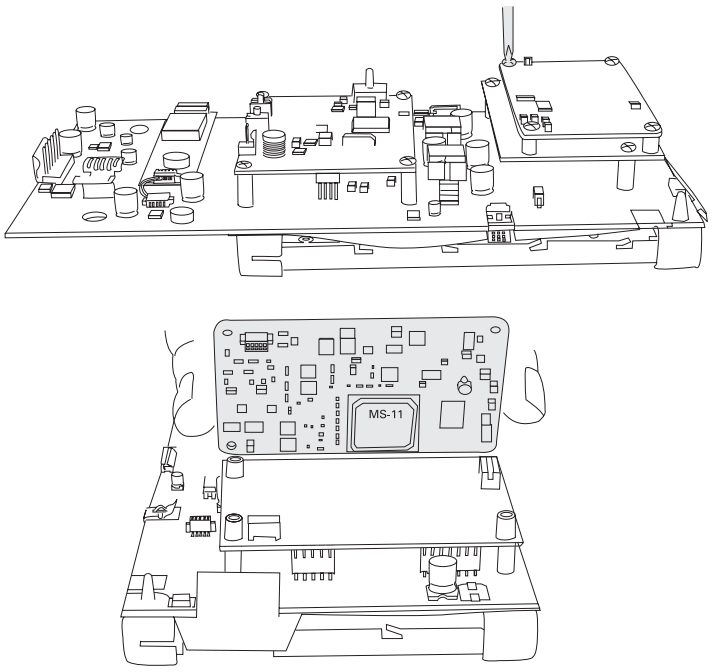
SpO_2 Circuit Board Disassembly

Note To assure proper SpO_2 operation, replace the SpO_2 board using only the Welch Allyn specified part.

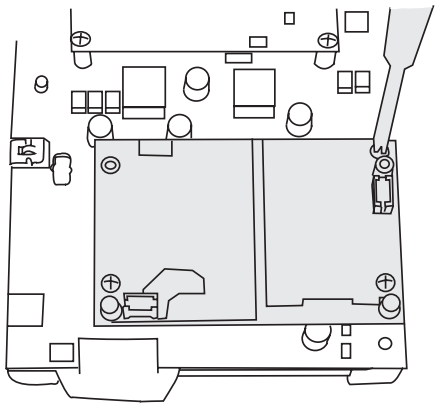
To assure patient electrical isolation, after the main board is nearly back in position, verity that the SpO_2 flex cable is freely floating in space and is not pressed up against the main board.

Masimo

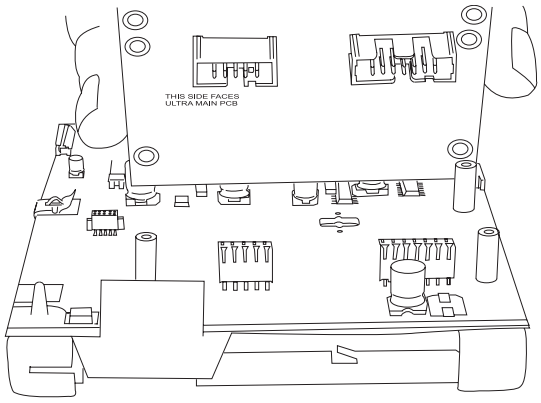
1. Lay the LCD flat on an ESD mat.
2. Find the double-stack of circuit boards and remove the four corners screws. Carefully lift the circuit board straight up.



3. Remove the three screws on the circuit board located behind the LCD.



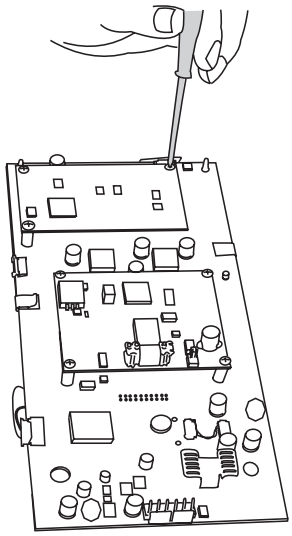
4. Slightly rock the circuit board back and forth while lifting straight up.



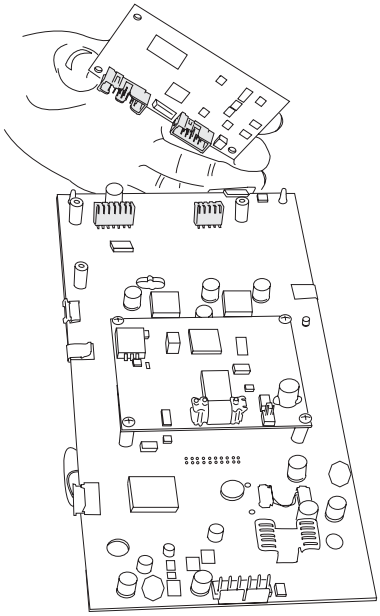
5. Replace with a new circuit board.

Nellcor

1. Lay the LCD flat on an ESD mat.
2. Remove the three screws on the circuit board located behind the LCD.



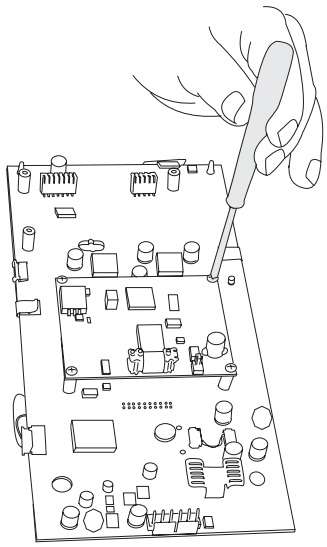
3. Slightly rock the circuit board back and forth while lifting straight up.

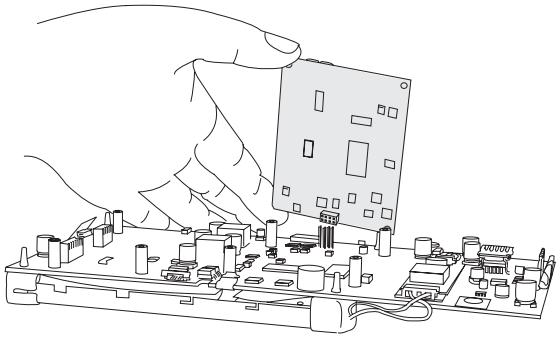


4. Replace with a new circuit board.

Blood Pressure Circuit Board Disassembly

Remove the four screws and carefully lift the circuit board straight up. There is one stationary connector.



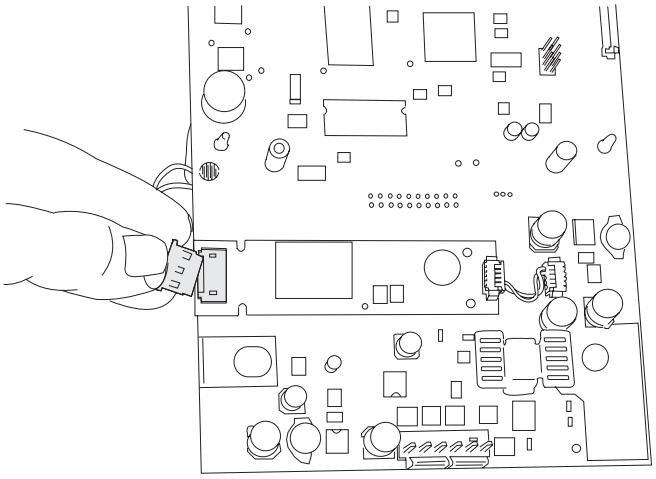


LCD Inverter Ballast Board Disassembly

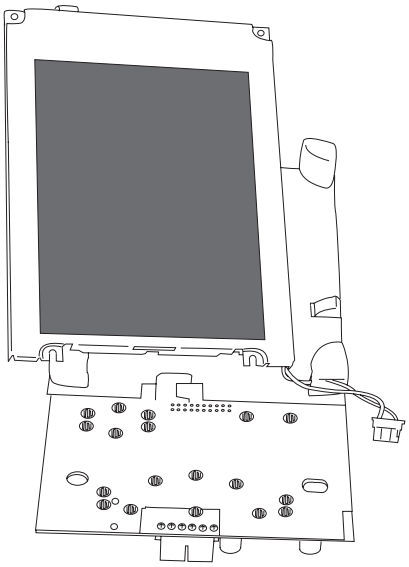
This is a small board held in place with two-sided tape. It is located towards the bottom of the main board. Remove the connector at each end and pull straight up.

LCD Disassembly

1. Remove the main board. At the bottom of this board is a circuit board with a pink connector at the bottom.



2. Pull the brown tabs of the top connector forward and remove the ribbon cable.
3. Turn the board over, pull back the soft rubber holders, and remove the LCD.



4. Replace with a new LCD.

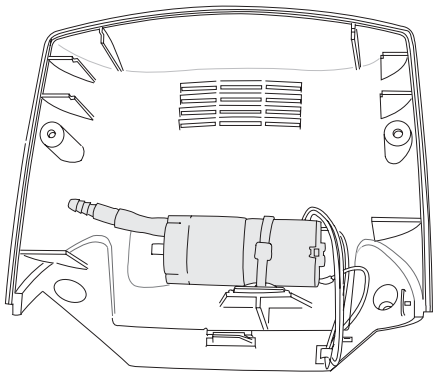
Pump Disassembly

Note For proper blood pressure operation, replace the pump using only the Welch Allyn specifed part.

To assure patient electrical isolation, route the pump wires through the rear housing clip feature (near the pump terminals) and held in place with a tiewrap to the holes in the rear housing at the back of the battery compartment.

To assure patient electrical isolation, do not modify the length of the pump wires.

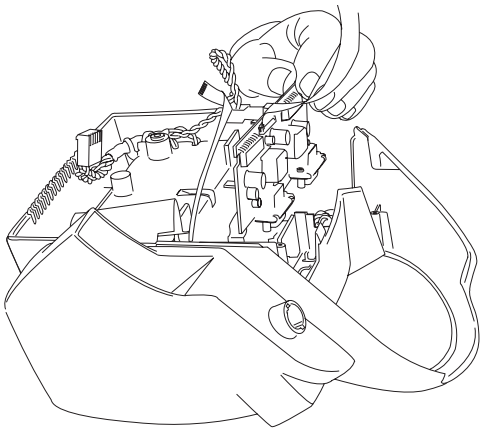
1. Snip the wire ties (2 places).



2. Disconnect the pneumatic tubing and unhook the wiring.
3. Replace with a new pump.

RS232-Communication Circuit Board Disassembly

1. Remove the pneumatic connector from the pump and the two screws.
2. Release the catch and remove the cover and inner handle assembly.
3. Remove the connection port panel.
4. Inside the back housing, remove the two screws.
5. Slide the board straight out and remove the connector.



6. Replace with a new circuit board.

Fan and Power Circuit Board Disassembly

Note To prevent buildup of hydrogen gas, replace the fan using only the Welch Allyn specified part.

This is a small board held in place with two-sided tape and one connector. Remove the screw before disconnecting the connector.

Thermometry Circuit Board Disassembly

Note To assure patient electrical isolation, trap the flex cable to the thermometer pod behind the clip on the main housing adjacent to the main board connection point.

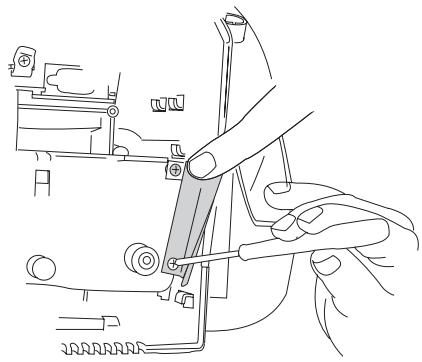
To assure patient electrical isolation, verify that the correct flex cable is used to connect the thermometer pod to the main board. The Braun and SureTemp Plus flex cables are slightly different in length and are not interchangeable.

To protect the user from high voltage, properly install the thermometer pod insulating paper separating the LCD ballast wires from the housing crack.

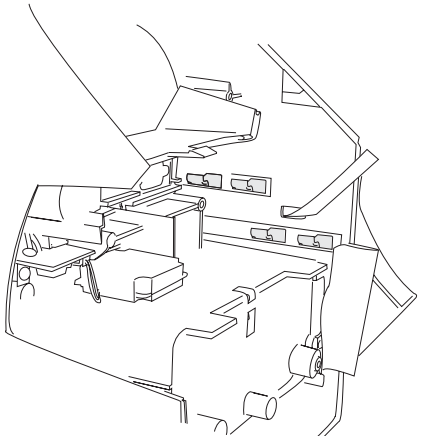
SureTemp Plus

Note Do not attempt to repair or clean the solder joints on either SureTemp Plus board. Incorrect flux or technique can degrade thermomter accuracy.

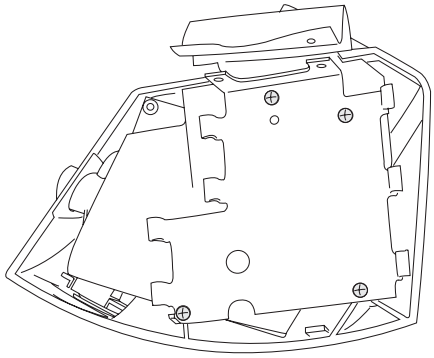
1. Remove the two screws located at the thermometer housing with a T-10 torx wrench. Save the fish paper.



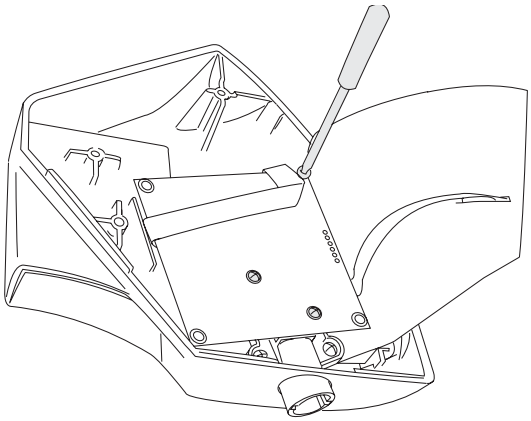
2. Locate the path of the notched tabs on the housing. Slide the housing up and out following this path and set the case aside.



3. Remove the four screws from the mounting plate and save the fish paper. This exposes the circuit board.



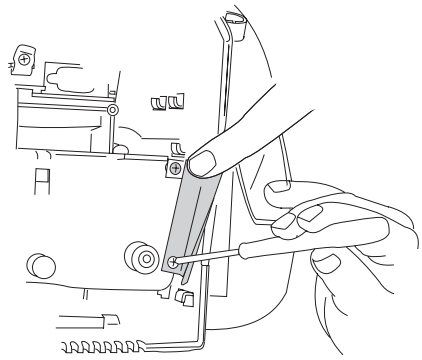
4. Remove the three screws on the board (one on top and one on either side of the probe well cover) and lift the board out of the housing.



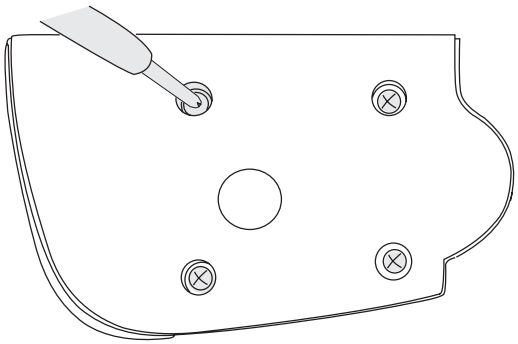
5. Disconnect all connectors and replace with a new board.

Braun ThermoScan PRO 4000

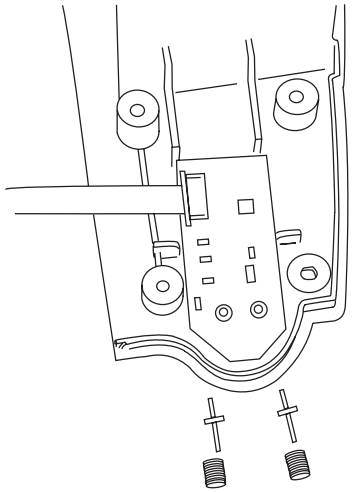
1. Remove the two screws located at the thermometer housing with a T-10 torx wrench. Save the fish paper.



2. Locate the path of the notched tabs on the housing. Slide the housing up and out following this path and set the case aside.



3. Remove the springs and posts. Carefully rock the board back and forth while lifting straight up.



4. Disconnect all connectors and replace with a new board.

7 Technical Overview

System Description

The Spot Vital Signs LXi automatically measures systolic and diastolic pressure (excluding neonates), pulse rate, temperature (oral, adult axillary, pediatric axillary, rectal, and ear), and pulse oximetry (SpO_2) as well as calculates Mean Arterial Pressure (MAP). Furthermore, Spot Vital Signs LXi allows the entry of height, weight, respiration rate, and pain level. Spot Vital Signs LXi also calculates Body Mass Index (BMI) following height and weight entry.

The device is intended to be used by clinicians and medically qualified personnel. It is available for sale only upon the order of a physician or licensed health care provider.

Refer to the Spot Vital Signs LXi Directions for Use manual for complete information.

Battery System

Spot LXi includes a 6 Volt, 6 amp-hour sealed lead-acid battery that supplies all power to the device. An external power supply charges the battery. The battery is always on-line (floated) rather than switching out when attached to the external power supply.

Spot LXi uses a fuse and a shunt diode for protection against reverse battery connections. The fuse is located on the main board in the negative battery line and a reverse battery connection causes it to blow and require repair. The negative line location is more likely to short the battery (+) wire to ground than short the battery (-) wire to the VBUS node.

Battery Charger

Provides two levels of power to fast-charge or to float the battery at fixed voltages using software control. The fast-charge level rapidly brings the battery up to near-full capacity (7 Volts) using software to not overcharge the battery. The float level, set per the manufacturer's recommendation, slowly tops-off the battery and can stay on indefinitely.

"CPU I/O" Power Supply

Provides power to the I/O pins of the DragonBall MPU and the attached peripheral IC's. The nominal voltage is set to a value of 3.15 Volts so that both the 3.0 Volt MPU and 3.3 Volts peripherals can operate within specifications. Spot LXi uses buck switching topology for efficiency and an on-off power latch directly controls the power supply.

CPU Core Power Supply

Powers the MPU core only and operates at the recommended Dragonball voltage range of 1.8 +/- 0.1 Volts; 2.0 Volts absolute max.

The +3.15 Volt supply powers the +1.8 Volt supply for efficiency and, more importantly, for power sequencing. During power-on the +1.8 Volt supply cannot exceed the +3.15 Volt supply. The R207/C182 further delays the +1.8 Volt supply. During power-off, D106 prevents the +1.8 Volt supply from exceeding the +3.15 Volt supply by more than a partial diode drop.

+5V Supply

Provides supply to miscellaneous loads that require more than 3.15 Volts. The Power Latch controls the supply and the average load current is small, so efficiency is not important.

Clock/Calendar Power

The Clock/Calendar U19 receives power from two sources. During power on the clock runs from the +5 Volt supply and during power down the clock receives power directly from the battery potential using a voltage divider. Capacitor C131 provides power to the U19 during the battery exchanges. Zener D102 prevents overvoltage to U19 in the case of operation directly from the charger.

Mod F NIBP Power

This module is powered directly from VBUS through an EMI filter. Software via BP-PWR-ON-BAR controls the power. Level shifter Q115 / Q104 assures that the module remains off when the MPU is unpowered.

SpO_2 and Thermometer Power

A common structure supplies SpO_2 and thermometry. A single push-pull driver delivers squarewave power to a pair of isolation transformers, one for SpO_2 and the other for thermometry. THERM-PWR-BAR activates the driver under software control. Level shifter Q118, Q119 assures that the module remains off when the MPU is unpowered.

In the push-pull (forward) configuration, VBUS is multiplied by the transformer turns ratio and supplied to the input of the rectifier diodes. This is filtered and passed through low-noise 5-Volt linear regulators to supply power to the parameter modules.

LCD Power

The LCD data interface connects directly to the +3.15 Volt MPU I/O power supply. This powers the driver ICs inside the LCD pane and assures the data interface to the LCD is always powered when the unit is powered.

The contrast (bias) supply to the LCD panel and the LCD CCFL backlight both derive power indirectly from a pre-regulator. A software control can shut down the pre-regulator. For efficiency, it is implemented as a buck switcher operating directly from the battery. The primary purpose of the pre-regulator is to protect the backlight inverter / ballast from battery voltages that it cannot tolerate and to control current out of the unregulated ballast. The voltage is set to the low side of 5 Volts to reduce battery consumption, while still driving the CCFL with adequate voltage.

External Load (RS-232) Power

There are two power outlet means on the Spot LXi – RS-232 port power and the Braun PRO 4000 charger.

Two isolated power supplies provide power to each of the external RS-232 ports. This power is available to external devices on pin 9 of each serial connector whenever the software enables the corresponding RS-232 port.

SureTemp Plus Thermometer Interface

The SureTemp Plus OEM module is located in an optional pod and is connected to the main PCB via a flex cable.The Thermometer Probe connection is located on a separate PC board. It is connected to the SureTemp Plus OEM module by a ribbon cable. The electrical interface to the thermometer pod is a 6-pin ribbon connector, Molex 52271-0690 or equivalent.

Braun ThermoScan PRO 4000 Thermometer Interface

The interface to the Braun ThermoScan PRO 4000 thermometer is located in the optional pod and connects to the main PCB via a flex cable. The communications link is a single duplex current loop that also charges the Braun battery pack.

The presence or absence of current passing through the Braun ThermoScan PRO 4000 charge contacts controls the interface charge LED, located within the pod, which mimics the Braun ThermoScan Pro 4000 Base Station (type 6021).

SpO_2 Description

A shielded flat-flex cable connects the user interface sensor connector J8 to the SpO_2 electronics.

The Masimo SpO_2 module mates to the Masimo Adaptor Board that, in turn, mates to the Main board. This provides power and communications to the module from the Main board.

The Nellcor SpO_2 module mounts directly to the Main board. This provides power and communications to the module, and brings the sensor signals to the main board where EMI and ESD can be controlled. The sensor signals pass through the main board to the mating connector for the shielded flat-flex cable.

Bar Code Scanner Description

The bar code scanner is the IMAGETEAM™ 3800/3900, programmed as follows:

Parameter	Setting	Factory Default
Terminal Interfaces:		
Baud Rate:	9600	9600
Data Bits:	7	7
Stop Bits:	7	7
Parity:	Even	Even
Handshaking:	None	None
Output:		
Scan Rate:	67 s/s	270s/s
Beeper Volume:	Off	High
Trigger Mode:	Manual Trigger, Low Power	Manual Trigger
Lower Power Time Out:	5 seconds	-
Data Editing:		
Prefix[1]:	<STX><SOH><DC2> (Ctl-BAR)	None
Suffix[1]:	<CR><LF>	<CR><LF>

NOTES:
1. Applies to all symbologies.

The bar code scanner interfaces to Spot LXi through an isolated RS-232 DB-9 Female connector. A standard IMAGETEAM™ 3800/3900 cable is required for use with the scanner.

Printer Description

All models of the Ap1300 printer use an industry standard RS-232 interface. The default parameters are 9600 baud, 8 data bits, 1 stop bit, and no parity.

Serial data is expected in standard RS-232C format with -12 Volt meaning 'mark' or '1' and +12 Volt a logical '0', with reference to the common ground. The serial data output line, TxD, transmits XON/XOFF and status information to the host at the same Baud rate and in the same format as the serial data input. The hardware busy line is true (nominal -12 Volt) when busy. Both serial output lines will relax to approximately 0 Volt when the Ap1300 is in sleep mode and the user must allow a short period after awakening before relying on the values of these signals.

The Ap1300 has three operating modes, when not actually printing.

Idle Mode	Ready to accept data, but no data are in the buffer awaiting printing and the printer motor is not running.
Sleep Mode	Effectively switched off.
Spool Mode	Active, but storing data for later printing.

Different color combinations on the front-panel LED indicate the modes. No light is emitted in sleep mode.

Table 14. LED Pattern Table

Pattern	Battery	Buffer Mode
Constant Green	Running	Normal
Fast Flashing Green	Running	Spool *
Long Green - Short Red	Battery Low	Normal
Short Green - Short Red	Battery Low	Spool *
Short Green - Long Orange	Trickle Charging	Normal
Long Orange Flash	Trickle Charging	Spool *
Fast Flashing Orange	Fast charging	Spool (Printing prohibited)
Fast Flashing Red	Error Condition	Spool (Printing prohibited)
No Light	Flat or in sleep mode	
* Spool may have resulted from Paper Out or Head Up conditions)		

No hardware power switch is fitted, as power control is either automatic or by command from the host computer. To save power, the printer enters sleep mode after a period of inactivity, factory-set to 30 seconds, but prorammable from the host. It can also be programmed to stay idle indefinitely or to go to sleep on command.

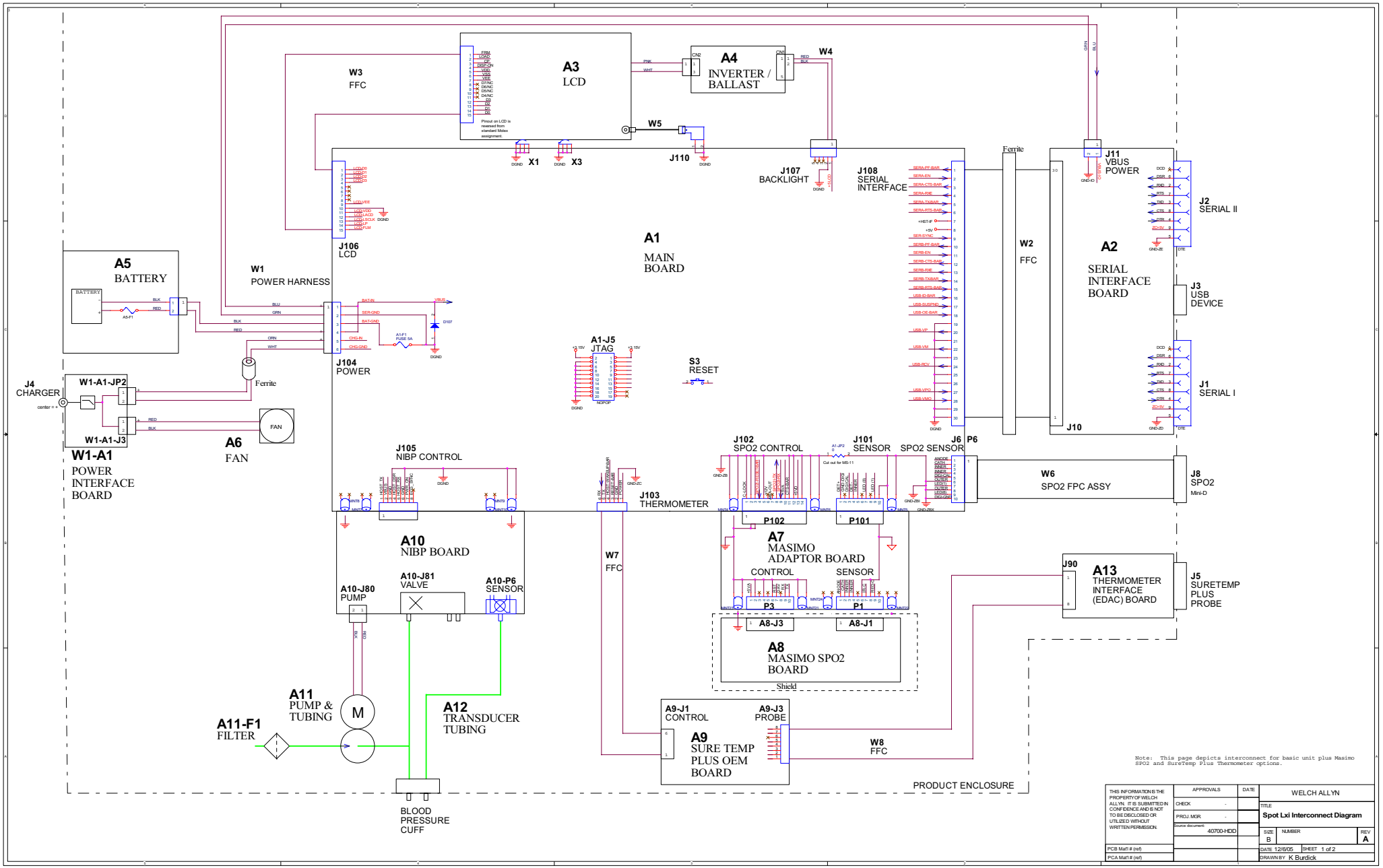
The Ap1300 utilizes Fujitsu FTP-628MCL 103 printer mechanism, with a fixed (parallel) print head with 384 horizontally-arranged thermal elements. A stepper motor advances the paper and the printing takes place in a single-dot row for each step of the paper. Each printed dot is approximately 1/8 mm square. The printing speed and dot density are controlled according to the battery voltage and the head temperature.

The Spot LXi provides two levels of power to fast-charge or to float the battery at fixed voltages using software control. The fast-charge level rapidly brings the battery up to near-full capacity (7 Volts) using software to not overcharge the battery. The float level, set per the manufacturer's recommendation, slowly tops-off the battery and can stay on indefinitely.

Interconnect Diagram

Item	Description	Item	Description
A1	PCA, Main, Spot LXi	W1	Assy, Power Harness, Spot LXi
A1-F1	Fuse, FlastBlo, 5A	W1-A1	PCA, Power Interface, Spot LXi
A2	PCA, Serial Interface, Spot LXi	W2	Flex, Main, Spot LXi
A3	Display, LCD, 320 x 240, Mono	W3	Cbl Flx, 1/2mm, 15 POS
A4	Inverter, LCD	W4	Assy, Ballast Harness, Spot LXi
A5	Assy, Battery, Spot LXi	W5	Assy, LCD Gnd Harness
A5-F1	Wire Protection Fuse	W6	Assy, Cable, Flat Flex, SpO_2
A6	Assy, Fan Unit Cooling		Wire Clip, Side Entry, .375 Wide
A7	PCA, Masimo Adapter, Spot LXi		Foam Strip, 2 Sided Adhesive
A8	Masimo MS-11 SpO_2	W7	Cbl, Flx, 1mm, 6POS
	Shield, Masimo EMI	W8	Cbl, Flx, 1mm, 8POS
	Tape, Copper, Masimo Shield	W9	Cbl, Flx, Braun, Spot LXi
A9	PCA, SureTemp Plus, OEM w/o EDAC		
A10	PCBA, BP OEM, (MOD F)		
A11	Assy, Pump, and Tubing, Spot LXi		
A11-F1	Filter, Air, 1/8 Barbs		
A12	Assy, Transducer Tubing, Spot LXi		
A13	PCA, EDAC, Spot LXi		
A14	Nellcor MP506 SpO_2 PCB		
A15	PCA, Braun Interface, Spot LXi		

	Wire Color
BLK	Black
BRN	Brown
RED	Red
ORN	Orange
GRN	Green
BLU	Blue
PNK	Pink


A3
LCD
A4
INVERTER / BALLAST
W3
FFC
W4
W5
J110
X1
X3
J107
BACKLIGHT
J108
SERIAL INTERFACE
Ferrite
J11
VBUS POWER
J2
SERIAL II
A1
MAIN BOARD
W2
FFC
A2
SERIAL INTERFACE BOARD
J3
USB DEVICE
J1
SERIAL I
J10
A5
BATTERY
W1
POWER HARNESS
J106
LCD
J104
POWER
A1-J5
JTAG
S3
RESET
J4
CHARGER
W1-A1-JP2
W1-A1-J3
Ferrite
FAN
A6
FAN
W1-A1
POWER INTERFACE BOARD
J105
NIBP CONTROL
J102
SPO2 CONTROL
J101
SENSOR
SPO2 SENSOR
J6
P6
W6
SPO2 FPC ASSY
J8
SPO2
Mini-D
J103
THERMOMETER
P102
P101
A7
MASIMO ADAPTOR BOARD
CONTROL
SENSOR
P3
P1
A10
NIBP BOARD
A10-J81
VALVE
A10-P6
SENSOR
A10-J80
PUMP
W7
FFC
A8-J3
A8-J1
A8
MASIMO SPO2 BOARD
Shield
J90
A13
THERMOMETER INTERFACE (EDAC) BOARD
J5
SURETEMP PLUS PROBE
A11
PUMP & TUBING
M
A11-F1
FILTER
A12
TRANSDUCER TUBING
A9-J1
CONTROL
A9-J3
PROBE
A9
SURE TEMP PLUS OEM BOARD
W8
FFC
PRODUCT ENCLOSURE
BLOOD PRESSURE CUFF
Note: This page depicts interconnect for basic unit plus Masimo SPO2 and SureTemp Plus Thermometer options.
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APPROVALS
DATE
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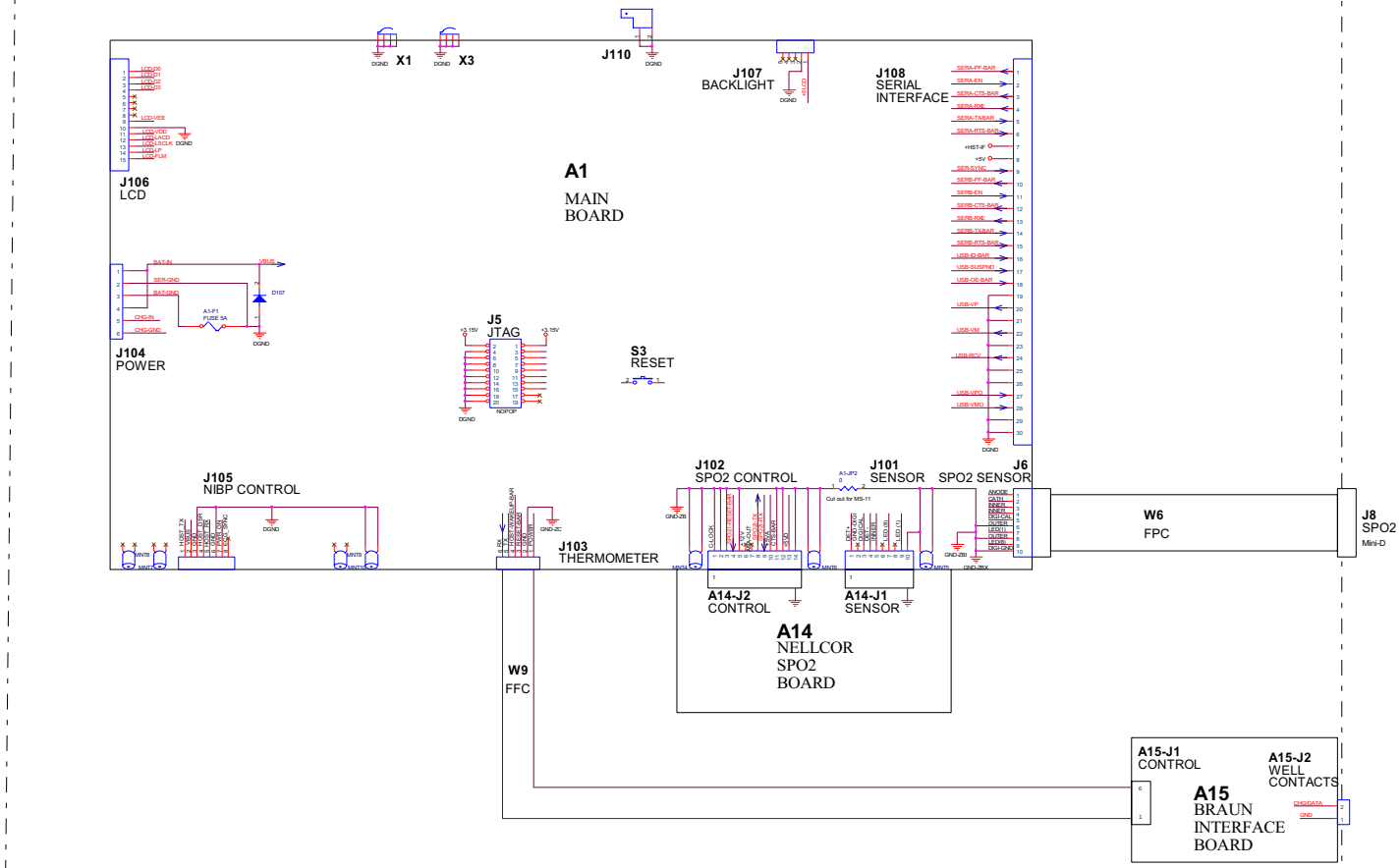
TITLE
Spot Lxi Interconnect Diagram
Source document: 40700-HDD
SIZE B
NUMBER
REV A
DATE 12/6/05
SHEET 1 of 2
DRAWN BY K Burdick
PCB Mat'l # (ref)
PCA Mat'l # (ref)



Note: This page depicts interconnect for Nellcor SPO2 and Braun Thermometer options only.

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	Source document: 40700-HDD		SIZE B / NUMBER / REV A
PCB Mat'l # (ref)			DATE 12/6/05 SHEET 2 of 2
PCA Mat'l # (ref)			DRAWN BY K Burdick

8 Field Replaceable Units

The following list identifies the available FRUs for Spot Vital Signs LXi. To order an FRU, contact Welch Allyn Technical Support.

Table 15. Spot LXi Base Components

Component Number	Object Description
400163	ASSY, POWER HARNESS, SPOT LXi
400170	ASSY, PUMP HARNESS
400198	PCA, SERIAL INTERFACE, SPOT LXi
400199	PCA, MAIN, SPOT LXi
400200	BASE UNIT, SURETEMP, NELLCOR - SPOT LXi
400203	BASE UNIT COMPONENTS, SPOT LXi
400207	LANGUAGE COMPONENTS, ENG, SPOT LXi
400208	ASSY, PUMP & VALVE TUBING SPOT LXi
400387	PBCA BP OEM, (MOD F)
400720	ASSY, BALLAST HARNESS, SPOT LXi
400732	ASSY, BATTERY, SPOT LXi
421051-12	TUBING,1/8 X 1/4 X 2.50
421051-9	TUBING,1/8 X 1/4 X 0.95
59P586	FOOT, RUBBER
620028-E	LABEL, CAUTION
620217	FITTING, "T", 1/8 X 1/16X 1/8
700101	HSG, HANDLE, LXi
700102	HSG, HANDLE INSERT, LXi
700103	HSG, REAR, LXi
700105	HSG, BATT DOOR, SPOT LXi
700110	BUMPER, LCD, SPOT LXi
700113	HSG, BEZEL, SPOT LXi
700114	SWITCH ARRAY, SPOT LXi
700115	WINDOW, LCD FRONT, SPOT LXi
700119	INVERTER, LCD
700824	HOUSING, FRONT, SPOT LXi
700851	BRACKET, MOUNTING, SPOT LXi

Table 15. Spot LXi Base Components

700852	PCB, POWER INTERFACE, SPOT LXi
704423	HSG, PANEL, SPO2-BLANK, LXi
401427	LABEL, ICON ID, SPOT LXi
700863	CBL,FLX, 1/2mm,15POS,1.0"
704375	CBL,FLX, 1/2mm,30POS,6.0"
703956	LABEL, BATTERY
701040	FITTING, PLASTIC L, 1/16 X 1/16
701502	Valve,Pneumatic,6PSI,5V,TH
703077	STANDOFF, PCB, BROACHING, #4 X .500 LG
703118	BATTERY CLIP, AA, SINGLE
703354	DISPLAY,LCD,320X240,BLITE,MONO,3.3V,5.7"
703355	FILTER, AIR, 1/8 BARBS
703842	TUBING, SILICONE, .063ID X .125OD X 5.50

Table 16. SureTemp Plus Components

Component Number	Object Description
02692-100	PROBE ASSY,ORAL 9FT
02894-0000	ASSY,PRB WLL,BLUE,OEM,M690_692
20500-025	PACKAGING ASSY, CLEAR 25PK
400194	ASSY, SURETEMP+ COMPONENTS, SPOT LXi
400195	PCA, SURETEMP+, OEM W/O EDAC, CALIBRATED
400196	PCA, EDAC, LXi
700111	HOUSING, THERM OEM POD, LXi
700112	PLATE, POD MOUNTING, LXi
700858	CBL,FLX,1MM,6POS
700859	CBL,FLX,1MM,8POS
70999-0000	LABEL,SURETEMP TECHNOLOGY
02692-100	PROBE ASSY,ORAL 9FT

Table 17. Braun ThermoScan PRO 4000 Components

Component Number	Object Description
400652	PCA, BRAUN INTERFACE, SPOT LXi
700112	PLATE, POD MOUNTING, LXi
700820	HSG, BOTTOM, BRAUN POD, SPOT LXi
700822	HSG, BRAUN POD, SPOT LXi
704365	WINDOW, BRAUN POD, SPOT LXi
700859	CBL,FLX,1MM,8POS
703161	SECURITY LOCK, BRAUN POD, SPOT LXi

Table 17. Braun ThermoScan PRO 4000 Components

Component Number	Object Description
400652	PCA, BRAUN INTERFACE, SPOT LXi
703162	LATCH, BRAUN POD, SPOT LXi
703164	CONTACT, BRAUN POGO, SPOT LXi
703165	SPRING, COMPRESSION
703192	COVER, BRAUN SECURITY, SPOT LXi

Table 18. Masimo SpO_2 Components

Component Number	Object Description
008-0648-00	MASIMO - ADULT RESU. SENSOR
008-0692-01	MASIMO - 8' INTERFACE CABLE
400192	PCA, MASIMO OEM, SPOT LXi
400205	MASIMO SPO2 COMPONENTS, SPOT LXi
400555	PCA, MASIMO ADAPTOR, SPOT LXi
400610	ASSY, CABLE, FLAT FLEX, SPO2
704422	HSG, PANEL, SPO2-MASIMO, LXi

Table 19. Nellcor SpO_2 Components

Component Number	Object Description
400183	PCA, NELCOR OEM, SPOT LXi
400201	NELLCOR SPO2 COMPONENTS, SPOT LXi
400610	ASSY, CABLE, FLAT FLEX, SPO2
620377-1	"NELLCOR WORKS HERE" LABEL
704421	HSG, PANEL, SPO2-NELLCOR, LXi
DOC-10	CABLE, SP02 EXTENSION, NELCOR
DS-100A	DURASENSOR,ADULT,DS-100A

9 Specifications

Performance

This section describes normal ranges for Spot Vital Signs LXi.

Blood Pressure Accuracy

Blood pressure accuracy meets or exceeds AAMI SP10:2002 standards for non-invasive blood pressure accuracy (± 5 mmHg mean error, 8 mmHg standard deviation). Blood pressure accuracy is validated for pressure measurement using the upper arm only.

Cuff Pressure Range	0 to 300 mmHg
Systolic Range	60 to 250 mmHg
Diastolic Range	30 to 160 mmHg
Blood Pressure Determination Time	Typical: 15 seconds
Mean Arterial Pressure Range	40 to 190 mmHg
Pulse Rate Range (using SpO_2 determination)	25 to 240 bpm
Pulse Rate Range (using Blood Pressure determination)	35 to 199 bpm
Pulse Rate Accuracy (using SpO_2 determination)	Without Motion: 25 to 245 bpm ± 3 digits[1] With Motion: normal physiologic range (55 to 125 bpm) ± 5 digits Low Perfusion: 25 to 245 bpm ± 3 digits[1]
Pulse Rate Accuracy (using Blood Pressure determination)	±5.0%
Overpressure Cutoff	315 mmHg ±15 mmHg

[1] Specification applies to device performance and was validated with Biotek and Nellcor simulators.

Temperature Specifications

Temperature Range	
SureTemp Plus	80° to 110° F (26.7° to 43.3° C)
Braun ThermoScan PRO 4000	68° to 108° F (20° to 42.2° C)
Calibration Accuracy	
SureTemp Plus	±0.2° F (0.1° C) (Monitor Mode)
Braun ThermoScan PRO 4000 for displayed temperature ranges	± 0.4° F (±0.2° C) 95.9° to 107.6° F (35.5° to 42° C) ±0.5° F (±0.25° C) (outside this temperature range)
Display Resolution	0.1° F or ° C
SureTemp Plus Predict Time	
Oral	Approx. 4 to 6 seconds
Adult Axillary	Approx. 12 to 15 seconds (age 18 years and older)
Pediatric Axillary	Approx. 10 to 13 seconds (age 17 years and younger)
Rectal	Approx. 10 to 13 seconds

SpO_2 Specifications

Masimo Sensor Accuracy Guide

Accuracy specified when used with Masimo SET pulse oximetry monitors or with licensed Masimo SET pulse oximetry modules using PC series patient cables, during no motion. Numbers present ± 1 standard deviation. Plus or minus one standard deviation represents 68% of the population. SpO_2 accuracy from 70% to 100%. Pulse rate accuracy from 25 to 240 bpm.

Performance Measurement Range	SpO_2: 1 to 100% Pulse Rate: 25 - 240 beats per minute (BPM)
Perfusion	0.02% to 20%
Accuracy	Saturation: 70% to 100% No Motion: Adults, Pediatrics ± 2 digits Neonates ± 3 digits Motion: Adults, Pediatrics ± 3 digits Neonates ± 3 digits Low Perfusion: Adults, Pediatrics ± 2 digits Neonates ± 3 digits
Pulse Rate Accuracy	Pulse Rate: 25 to 250 bpm No Motion: Adults, Pediatrics, Neonates ± 3 digits Motion: Adults, Pediatrics, Neonates ± 5 digits Low Perfusion: Adults, Pediatrics, Neonates ± 5 digits

Table 20. Masimo Sensor Accuracy Guide

		Saturation Accuracy		Pulse Rate Accuracy	
Sensor	**Weight Range**	**No Motion**	**Motion**	**No Motion**	**Motion**
LNOP-ADT	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-PDT	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-NEO	< 10 kg	± 3%	± 3%	± 3 bpm	± 5 bpm
LNOP-NEOPT	< 1 kg	± 3%	± 3%	± 3 bpm	± 5 bpm
LNOP-DCI	> 30 kg	± 2%	± 3%	± 3 bpm	± 5 bpm
LNOP-DCIP	10 to 50 kg	± 2%	± 3%	± 3 bpm	± 5 bpm

Masimo Patents

The Masimo sensors and cables are covered under one or more of the following U.S.A. patents: 5,758,644; 5,823,950; 6,011,986; 6,157,850; 6,263,222; 6,501,975; and other applicable patents listed at www.masimo.com/patents.htm.

Nellcor Sensor Accuracy Guide

Accuracy specifications are based on controlled hypoxia studies with healthy, non-smoking adult volunteers over the specified saturation SpO_2 range. Pulse oximeter SpO_2 readings were compared to SaO_2 values of drawn blood samples measured by hemoximetry. All accuracies are expressed as ± "X" digits. This variation equals ± one standard deviation (± 1 SD), which encompasses 68% of the population.

Table 21. OxiMax Sensor Models, Single Patient Use

Sensor Models	SpO_2 Range 70% to 100%
MAX-AI[1]	± 2
MAX-PI*	± 2
MAX-II	± 2
MAX-RI[2]	± 3.5

[1] The accuracy specification under motion conditions is ± 3. For a definition of motion, contact Nellcor Technical Services or your local Nellcor representative.
[2] The accuracy specification has been determined between saturations of 80% to 100%.

Table 22. OxiCliq Sensor Models, Single Patient Use

Sensor Models	SpO_2 Range 70% to 100%
OXICLIQ-PI	± 2.5

Table 23. Reusable Sensor Models

Sensor Models	SpO_2 Range 70% to 100%
D-YS (Infant to Adult)	± 3
D-YS and D-YSE	± 3.5
D-YS and D-YSPD	± 3.5
DS-100A	± 3
OXI-A/N (Adult/neonate)	Adult: ± 3 Neonate: ± 4
OXI-P/I (Pediatric/infant)	± 3

Nellcor Patents

Covered by one or more of the following US Patents: 4,802,486; 4,869,254; 4,928,692; 4,934,372; 5,078,136; 5,351,685; 5,485,847; 5,533,507; 5,577,500; 5,803,910; 5,853,364; 5,865,736; 6,083,172; 6,708,049; Re. 35,122 and foreign equivalents.

Mechanical

Dimensions	Height: 10.63 " (27 cm) Length/Braun: 8" (20.32 cm) Length/SureTemp Plus: 7.5" (19 cm) Depth: 5.25" (13.34 cm)
Weight	7.5 lbs (3.4 kg)
Mounting	Self-supporting on rubber feet Custom mobile stand Custom wall mount
Portability	May be hand-carried when held by the rear handle

Electrical

Power Requirements	Patient-rated isolation transformer is connected to AC mains: North American Version: 120VAC, 60Hz. 0.20A Input, 8VDC, 0.75A Output International Version: 240VAC, 50Hz 0.10A Input, 8VDC, 0.75A Output Australian Version: 240VAC, 50Hz, 13VA Input, 8VDC, 0.75A Output

Patents

Patents Pending

Battery

Sealed lead acid, with external charger.

The Spot LXi battery is 90 to 100% charged after 6 hours of charging. The rechargeable batteries in the Braun ThermoScan PRO 4000 thermometer requires an additional 1 hour to charge and the rechargeable batteries in the external printer require an additional 4 hours to charge. The battery automatically charges when Spot LXi is powered through the AC power transformer. An operator can use the device while the battery is charging; however, the battery charges faster when the instrument is not in operation.

Environmental

WARNING This device is not suitable for use in the presence of a flammable anesthetic mixture with air or oxygen or nitrous oxide. An explosion may result.

Operating Temperature	50° to 104° F (10° to 40° C)
Storage/Transport Temperature	Device with SureTemp Plus: -13° to 131°F (-25° to 55°C) Device with Braun ThermoScan PRO 4000: -4° to 122°F (-20° to 50°C)
Relative Humidity	15 to 95% (non-condensing)
Operating Altitude	-557 to 16,000 ft. (-170 to 4877 m)

Wireless Radio

Wireless Network Interface	IEEE 802.11b DSSS, WiFi compliant
Frequency	2.4 to 2.4835 GHz

Guidance and Manufacturer's Declaration

Emissions and Immunity Information

Electromagnetic Emissions

The Spot Vital Signs LXi is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs LXi should assure that it is used in such an environment.

Emissions Test	Compliance	Electromagnetic Environment - Guidance
RF emissions CISPR 11	Group 1	The Spot Vital Signs LXi uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The Spot Vital Signs LXi is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Electromagnetic Immunity

The Spot Vital Signs LXi is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs LXi should assure that it is used in such an environment.

Immunity Test	IEC 60601 Test Level	Compliance Level	Electromagnetic Environment - Guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 6 kV contact ± 8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/ burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.

Voltage dips, short interruptions, and voltage variations on power supply input lines. IEC 61000-4-11	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	>95% dip in 0.5 cycle 60% dip in 5 cycles 30% dip for 25 cycles >95% dip in 5 seconds	Mains power quality should be that of a typical commercial or hospital environment. If the user of the Spot Vital Signs LXi requires continued operation during power mains interruptions, it is recommended that the Spot Vital Signs LXi be powered from an uninterruptible power supply or battery.
Power frequency (50/60Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

Electromagnetic Immunity

The Spot Vital Signs LXi is intended for use in the electromagnetic environment specified below. The customer or user of the Spot Vital Signs LXi should assure that it is used in such an environment.

Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the Spot Vital Signs LXi, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended separation distance**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = (1.17)\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	$d = (1.17)\sqrt{P}$ 80 MHz to 800 MHz $d = (2.33)\sqrt{P}$ 800 MHz to 2.5 GHz where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol:

Note 1: At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Spot Vital Signs LXi is used exceeds the applicable RF compliance level above, the electrocardiograph should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the electrocardiograph.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

Recommended Separation Distances Between Portable and Mobile RF Communications Equipment and the Spot Vital Signs LXi

The Spot Vital Signs LXi is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or user of the Spot Vital Signs LXi can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Spot Vital Signs LXi as recommended below, according to the maximum output power of the communications equipment.

	Separation Distance According to Frequency of Transmitter (m)		
Rated Max. Output Power of Transmitter (W)	**150 kHz to 80 MHz** $d = (1.17)\sqrt{P}$	**80 MHz to 800 MHz** $d = (1.17)\sqrt{P}$	**800 MHz to 2.5 GHz** $d = (2.33)\sqrt{P}$
0.01	0.117	0.117	0.233
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.70	3.70	7.37
100	11.70	11.70	23.30

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

Note 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

Note 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects, and people.

10 Maintenance and Service

Cleaning

WARNING Before performing any maintenance or service to the Spot LXi, disconnect the AC power line from the electrical outlet.

Spot Vital Signs LXi

Caution Prevent water or other fluids from entering any connectors. If the connectors get wet, dry them with warm air. Check all measurement functions.

Caution Do not sterilize or autoclave the Spot LXi device.

As necessary, clean the device with a cloth slightly dampened with either 70% isopropyl alcohol, 10% chlorine bleach solution, or mild detergent in water, or use PDI Sani-System Cloths. Never immerse Spot LXi in any type of fluid.

Blood Pressure Cuff

Before washing the Reusable Two-Piece Cuff, remove the two connectors and bladder, close off tubes with plugs (available as accessory 5082-163), and close the hook and loop fasteners. After washing, allow the cuff to air dry. Re-assemble the tube fittings.

Never press with an iron.

Blood Pressure Hose and Cable

Wipe the pressure hose with a damp cloth moistened in a mild detergent solution. Do not immerse hose.

SureTemp Plus Thermometer

Temperature Probe

Caution DO NOT immerse or soak the probe in any type of fluid.

Caution DO NOT use steam, heat, or gas sterilization on the probe.

Caution DO NOT autoclave the probe.

Press down on the connector tab and slide the connector out of the port to remove the temperature probe.

Regularly wipe the probe with a cloth dampened with warm water and a mild detergent solution, a 70% isopropyl alcohol solution, or a 10% chlorine bleach solution.

Removable Probe Well

Caution DO NOT use hard or sharp objects to clean the probe well. This could damage the probe well and cause the device to not function properly.

Caution DO NOT use steam, heat, or gas sterilization on the probe well.

Caution DO NOT autoclave the probe well.

1. Remove the temperature probe from Spot LXi (see "Temperature Probe" on page 77).
2. Grasp the well under the probe opening and pull up gently to remove it from the device.
3. Swab the inner and outer surface of the probe well with a cloth dampened with a mild detergent solution, 70% isopropyl alcohol, or 10% chlorine bleach solution. Immerse the probe well in mild detergent solution as necessary for cleaning.
4. Dry all surfaces thoroughly before re-assembling the device (see "SureTemp Plus" on page 19) for reassembly instructions.

Braun ThermoScan PRO 4000 Thermometer

Use a soft cloth slightly moistened with alcohol to clean the thermometer display and exterior. Do not use abrasive cleaners.

Damage to the probe window or the presence of dirt or cerumen on the probe window can affect the accuracy of your temperature measurement. To clean the window, gently wipe it with a cotton swab slightly moistened with alcohol and immediately wipe dry with a clean cotton swab. Allow to dry at least five minutes before taking a temperature.

Every month, clean the Braun ThermoScan PRO 4000 charging contacts within the Spot LXi housing with a swab slightly dampened with alcohol.

SpO_2 Sensors

WARNING Do not immerse the sensor in water, solvents, or cleaning solutions (the sensors and connections are not waterproof). Do not use irradiation, steam, or ethylene oxide for sterilization.

Clean the reusable SpO_2 sensor with a 70% isopropyl alcohol solution. Do not immerse the sensor.

Printer

The printer label kit comes with a two-step head cleaner. Follow the directions provided with the cleaner.

Battery Replacement

Spot Vital Signs LXi

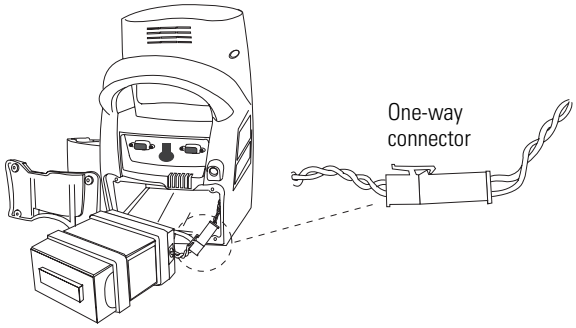
Caution Only use the Welch Allyn 4500-84 lead acid battery. Using an incorrect battery will cause damage to the Spot LXi and void the warranty.

Caution Do not break the shrinkwrap around the battery.

If necessary, replace the internal battery after heavy use or the battery no longer charges.

1. Power off the Spot LXi and disconnect the AC power transformer cord.
2. Remove the four screws holding the battery door using a phillips-head screwdriver. Remove the battery door to expose the battery.
3. Tip the Spot LXi backward and slide the battery out. Disconnect the one-way connector and then attach a new battery to the connector as shown. The one-way connector ends only connect one way. Do this as quickly as possibly to prevent loss of clock time.

Figure 13. Battery Removal and One-way Connector



4. Slide the battery into the compartment as far as it will go. Push the connector down into the case next to the battery.
5. Replace the battery door and tighten each of the four screws.
6. Connect the AC power transformer to the Spot LXi and allow the new battery to charge for approximately 6 hours. The rechargeable batteries in the Braun ThermoScan PRO 4000 thermometer requires an additional 1 hour to charge and the rechargeable batteries in the external printer require an additional 4 hours to charge. You can use the Spot LXi during this charging period via the AC power cord.

   If Spot LXi displays the E38 error code after power up, set the date (see "Date/Time Menu Options" on page 25).

The battery is a non-spillable lead-acid battery and must be recycled or disposed of properly according to national or local regulations.

Braun ThermoScan PRO 4000

Caution Do not use alkaline batteries in the Braun ThermoScan PRO 4000 thermometer.

Welch Allyn supplies a rechargeable battery pack with the Braun ThermoScan PRO 4000 thermometer.

1. Open the battery compartment.
2. Remove the battery pack and replace with a new battery pack, verify the poles are in the right direction.
3. Slide the battery door back in until it snaps into place.

   If the battery is completely discharged, the LEDs will not illuminate. Allow the unit to charge at least 15 minutes before proceeding.

The battery is a rechargeable battery and must be recycled or disposed of properly according to national or local regulations.

Printer

Caution Do not use alkaline batteries in the printer.

1. Open the battery compartment.
2. Remove the battery pack and replace with a new battery pack, verify the poles are in the right direction.
3. Slide the battery door back in until it snaps into place.

   Allow the printer to charge at least 15 minutes before proceeding.

The battery is a rechargeable battery and must be recycled or disposed of properly according to national or local regulations.

A Repair Test Specifications

This appendix refers to the Spot Vital Signs LXi without pneumatics (tubing and cuff), temperature probe, SpO_2 probe, or main battery attached, unless otherwise noted.

Use the Repair Software for the performing the tests on the Spot Vital Signs LXi. The standard test voltage, unless otherwise stated is 6.5 Vdc (+0/-0.25 Vdc). Unless otherwise stated, all calibrated volumes are ±10cc of the stated volume.

General Unit Test

A-D Noise Test

The A-D Noise Test is defined as the amount of noise on the Spot LXi A-D pressure channel; over a 1 second sample time while 0.0 mmHg is applied to the Device pressure port. The maximum limit is 0.050 mmHg.

Leak Test

The Leak Test is defined as the amount of pressure drop that is recorded over a 15-second interval with a 100cc cylinder attached to the Spot LXi pressure port and that volume having a stabilized pressure of 250 mmHg. The limit is 5 mmHg maximum.

Inflation Test

The Inflation Test is defined as the amount of time the Spot LXi pump can inflate a 250 cc cylinder from 5 mmHg to 210 mHg. The limit is 7 seconds, maximum.

Dump Test

The Dump Test is defined as the amount of time it takes Spot LXi to deflate a 500 cc cylinder from 260 mmHg to less than 15 mmHg. The limit is 10 seconds.

Pneumatic Accuracy Test

Enter the Internal Configuration Mode to perform this test (see "Internal Configuration Mode" on page 24).

Perform an Auto-zero before starting this test ("Blood Pressure Functional Check", Step 1 on page 35 through Step 5 on page 35). The Pneumatic Accuracy test is defined as the comparison of Spot LXi's pressure measurement and applied pressure at 0, 50, 150, and 250 mmHg. The specification for each reading is within ±3 mmHg of the target pressure except for the 0 mmHg reading which is within ±1.0 mmHg.

Valve Control Test

Connect a 100 cc cylinder to the Spot LXi pressure port and pressurize to 160 mmHg. Give Spot LXi the commands to open the valve for 10 mmHg/s, 15 mmHg/s, and 25 mmHg/s. Record each pressure drop: 4 to 12 mmHg, 4 to 15 mmHg, and 4 to 25mmHg, respectively.

Voltage Calibration

Calibrate the Spot LXi battery voltage measurement circuit at 5.5 Vdc (+0.1/-0.0 Vdc).

After performing a successful battery measurement circuit calibration, Spot LXi's memory will store a calibration signature of up to four printable characters.

Blank Mode Current Test

The Blank Mode Current Test is defined as the amount of current drawn through the battery terminals. All LCD segments, the back light, and the SpO_2 mode are all turned off. The limit is 200 mA maximum.

Back Light (Idle) Current Test

The Back Light Current Test is defined as the amount of current drawn through the battery. All LCD segments and the back light are turned on while the SpO_2 mode is turned off. The limit is 400 mA maximum.

Valve/Pump Mode Current Test

The Valve/Pump Mode Current Test is defined as the amount of current that is drawn through the battery terminals; Spot LXi is in the Blank Mode while the valve and pump are actuated to on. The limit is 700 mA maximum.

Interface Test

When given the proper commands, the Display Window will turn on or off all segments and turn on or off the back light. When given the proper command, the buzzer sounds to verify operation. The user determines the pass/fail criteria.

Temperature Option Requirements

Accuracy Test

Verify the accuracy of the temperature module is within ±0.2° F for readings with a nomal temperature of 97.3° F (36.3° C) using a Cal Key (5200-25). Verify Spot LXi can read a temperatures of 96.4° F (35.8° C) and 106° F (41.1° C) within ±0.3° F/±0.2° C using a Welch Allyn 9600 Plus Calibrator.

Temperature Probe Test

Spot LXi displays "ORL" after you remove the blue thermometer probe from the blue probe well.

SpO_2 Option Requirements

These tests are only valid on Spot LXi models with the Masimo or Nellcor SpO_2 option.

SpO_2 Functional Test

See "Masimo SpO2 Functional Check" or "Nellcor SpO2 Functional Check" on page 32 for the functional test.

SpO_2 Mode Current Test

The SpO_2 Mode Current Test is defined as the amount of current, less the Blank Mode Current, that is drawn through the battery terminals, placing Spot LXi in the Blank Mode, actuating the SpO_2 mode and applying any SpO_2 signal to the device. The maximum limit is 120 mA maximum.

Fail Safe Test

Over Pressure Test

Verify that Spot LXi can detect over pressure on the pneumatic system between 296.0 mmHg and 329 mmHg.

Over 15 mmHg

Verify that Spot LXi can detect static pressure over 15 mmHg for 180 seconds.

B Supplies and Accessories

Blood Pressure

Table 1. Reusable Two-Piece Blood Pressure Cuffs (1 per pack)

REF	Size	REF	Size
4500-01	Child	4500-03	Large Adult
4500-02	Adult	4500-04	Thigh

Table 2. Durable One-Piece Blood Pressure Cuffs (5 per box)

REF	Size	REF	Size
5082-82-4MQ	Infant	5082-86-4MQ	Adult
5082-83-4MQ	Small Child	5082-87-4MQ	Large Adult
5082-84-4MQ	Child	5082-88-4MQ	Thigh
5082-85-4MQ	Small Adult		

Table 3. Disposable One-Piece Blood Pressure Cuffs (5 per box)

REF	Size	REF	Size
5082-92-4MQ	Infant	5082-96-4MQ	Adult
5082-93-4MQ	Small Child	5082-97-4MQ	Large Adult
5082-94-4MQ	Child	5082-98-4MQ	Thigh
5082-95-4MQ	Small Adult		

Table 4. Miscellaneous Supplies and Accessories

REF	Description	REF	Description
4500-30	Blood Pressure Hose (5ft/1.5M)	5200-08	Calibration T-Connector

Temperature

Table 5. SureTemp Plus

REF	Description
02895-000	SureTemp Plus Oral Probe and Well (9 feet/2.7M)
02895-100	SureTemp Plus Rectal Probe and Well (9 feet/2.7M)
02894-0000	SureTemp Plus Oral Well
02894-1000	SureTemp Plus Rectal Well
06138-000	SureTemp Plus Temperature Calibration Key
01802-110	9600 Plus Calibration Tester
05031-101	Disposable SureTemp Plus Probe Covers (1,000 covers, packaged 25/box)

Table 6. Braun ThermoScan PRO 4000

REF	Description
04000-200	Braun ThermoScan PRO 4000 Thermometer (for North America, South America, and Asia Pacific)
04000-600	Braun ThermoScan PRO 4000 Thermometer (for Europe, Middle East, and Africa)
05075-800	Braun ThermoScan PRO 4000 Disposable Probe Covers (Case of 800 covers for North America, South America, and Asia Pacific)
04000-800	Braun ThermoScan PRO 4000 Disposable Probe Covers (Case of 800 covers for Europe, Middle East, and Africa)
01802-110	9600 Plus Calibration Tester
53020-0000	Braun ThermoScan PRO 4000 Rechargeable Battery Pack
4500-53	Braun Locking Key

Pulse Oximetry

Masimo Accessories

Table 7. Adhesive Sensors: Single-Patient Use

Catalog #	Description	Weight Range	Quantity
LNOP-ADT	Adult sensor	>66 lbs (30 kg)	20
LNOP-PDT	Pediatric sensor	22 to 110 lbs (10 to 50 kg)	20
LNOP-NEO	Neonatal sensor	<22 lbs (10 kg)	20
LNOP-NEOPT	SofTouch neonatal preterm sensor	<2.2 lbs (1 kg)	20

Table 8. Reusable Sensor

Catalog #	Description	Weight Range	Quantity
LNOP-DCI	Finger clip probe - adult	>66 lbs (30 kg)	1
LNOP-DCIP	Finger clip probe - pediatric	10 to 50 kg	1

Table 9. Sensor Cables

Catalog #	Description	Weight Range	Quantity
PC-04	4-foot cable with sensor connector	NA	1
PC-08	8-foot cable with sensor connector	NA	1
PC-12	12-foot cable with sensor connector	NA	1

Nellcor Accessories

Table 10. OxiMax Adhesive Sensors: Single-Patient Use

Catalog #	Description	Weight Range	Quantity
MAX-AI	MAX-A Adhesive Sensor, adult	>66 lbs (30 kg)	Case of 24
MAX-PI	MAX-P Adhesive Sensor, pediatric	22 to 110 lbs (10 to 50 kg)	Case of 24
MAX-II	MAX-I Adhesive Sensor, infant	6.5 to 44 lbs (3 to 20 kg)	Case of 24
MAX-RI	MAX-R Adhesive Sensor, adult nasal	>110 lbs (50 kg)	Case of 24

Table 11. OxiMax OxiCliq® Sensors: Reusable Cable with Adhesive Sensor Bandage

Catalog #	Description	Weight Range	Quantity
OC-3	OxiCliq Sensor Cable (3 ft / 91cm)	N/A	1
OXICLIQ-PI	OxiCliq P, pediatric	22 to 110 lbs (10 to 50 kg)	Case of 24

Table 12. OxiMax Resuable Sensors

Catalog #	Description	Weight Range	Quantity
DS-100A	Durasensor® DS-100A finger-clip sensor, adult	>88 lbs (40 kg)	1
OXI-A/N	Oxiband® OXI-A/N, adult/neonatal	< 6.5 lbs or > 88 lbs (<3 kg or >40 kg)	1
OXI-P/I	Oxiband OXI-P/I, pediatric/infant	6.5 lbs to 88 lbs (3 to 40 kg)	1
D-YS	Dura-Y® D-YS, multisite sensor	>2.2 lbs (1 kg)	1
D-YSE	D-YSE ear clip for Dura-Y sensor	>66 lbs (30 kg)	1
D-YSPD	PediCheck™ D-YSPD pediatric spot-check sensor	6.5lbs to 88 lbs (3 to 40 kg)	1

Table 13. OxiMax Sensor Cables

Catalog #	Description	Weight Range	Quantity
DOC-10	DOC-10 (10 ft/3M)	N/A	1

Miscellaneous

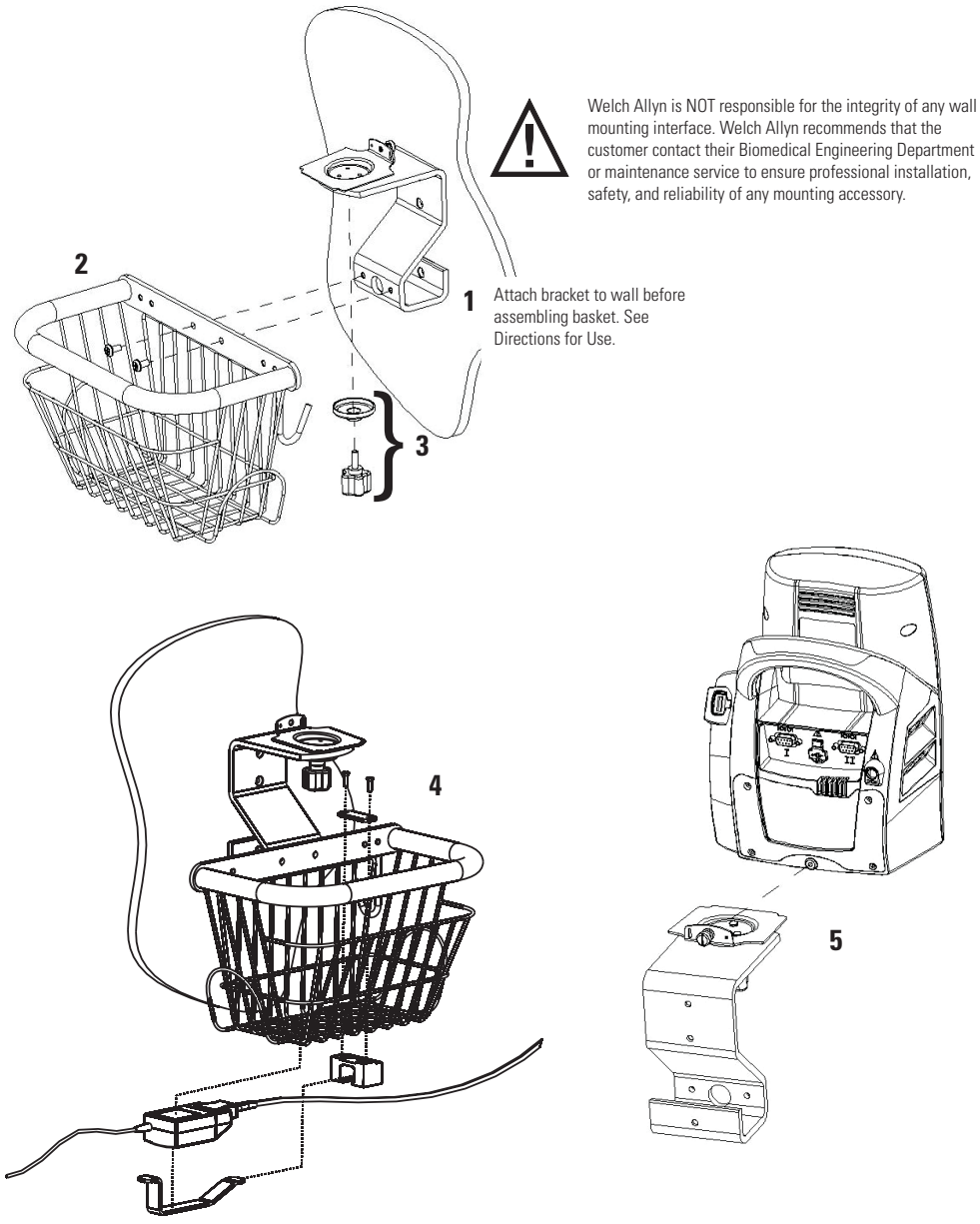
REF	Description
4500-60	Mobile Stand
4500-62	Wall Mount
4500-84	Lead Acid Battery
700860	Directions for Use
700862	Quick Reference Card
704432	Service Manual
4500-150E	Training Video
4500-100	Carrying Case
4500-101A	AC Power Transformer (desktop transformer, line cord not included)
4500-400	Line Cord (United States/Canadian/Japanese version)
4500-402	Line Cord (European version)
4500-404	Line Cord (United Kingdom version)
4500-406	Line Cord (Australian Version)
4500-408	Line Cord (South African version)
4500-500	Printer with Mounting Bracket
4500-505	Printer Rechargeable Battery Pack
4500-510	Printer Paper (10 rolls)
4500-520	Label Paper (10 rolls) and Cleaning Kit
4500-910	Barcode Scanner with Mounting Bracket
4500-920	DPAC Wireless Radio
4500-925	Cable for Wired Connectivity

Service Contracts

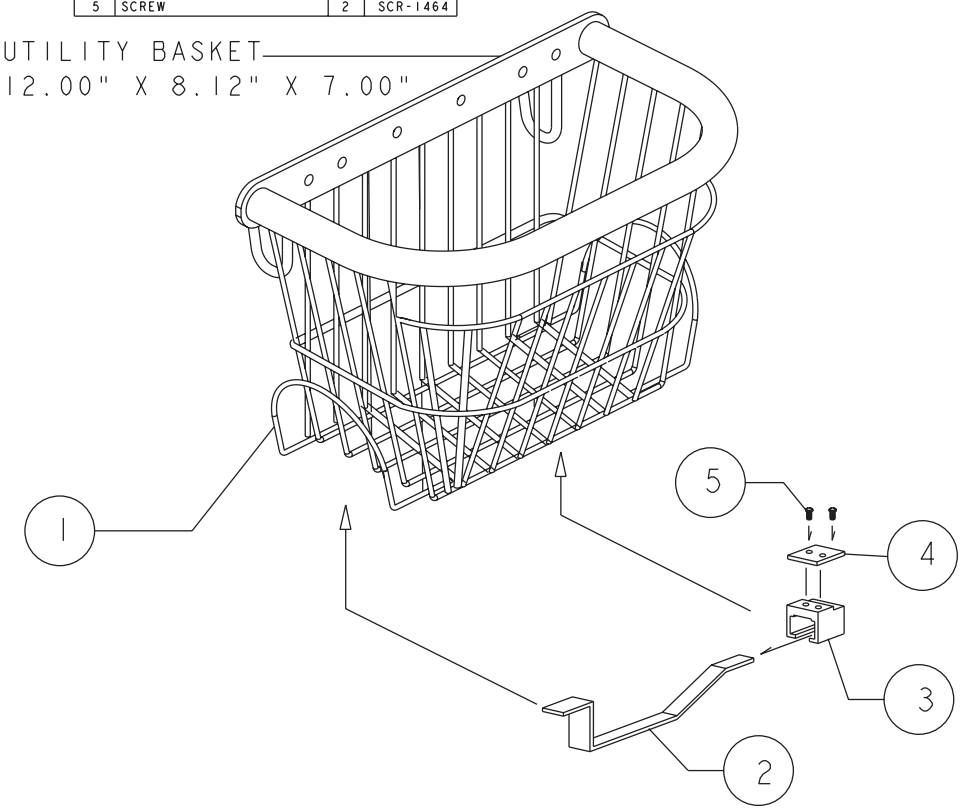
REF	Description
4500-BT0	Blood Pressure with Thermometry
4500-BTS	Blood Pressure with Thermometry and SpO_2

C Miscellaneous Mounting Accessories

Wall Mount Kit

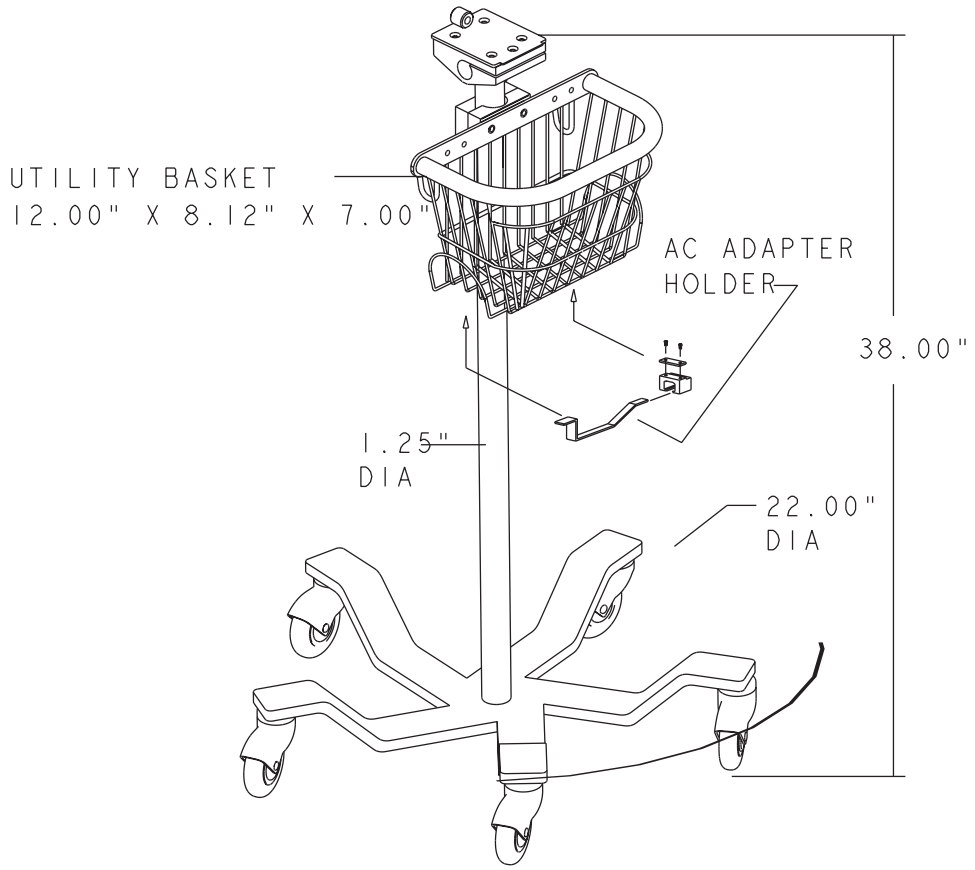

2
1
3
4
5
Welch Allyn is NOT responsible for the integrity of any wall mounting interface. Welch Allyn recommends that the customer contact their Biomedical Engineering Department or maintenance service to ensure professional installation, safety, and reliability of any mounting accessory.
Attach bracket to wall before assembling basket. See Directions for Use.

PARTS LIST			
ITEM	DESCRIPTION	QTY	P/N
1	BASKET	1	MIS-1574M
2	AC ADAPTER STRAP	1	STL-1534
3	ADAPTER BLOCK	1	PLS-1497
4	BLOCK CAP	1	STL-1534
5	SCREW	2	SCR-1464



WALL MOUNT BASKET WITH GRAY EPOXY FINISH. SPACE SAVING UNDER MOUNT AC ADAPTER HOLDER.
BULK SHIPPING PACK OF 8 UNITS. SHIPPING BOX IS 27.00" X 18.00" X 18.00" SHIPPING WEIGHT IS 15 LBS.
ITEM 1 TO BE PLACED IN A POLY BAG, ITEMS 2-5 TO BE PLACED IN A POLY BAG.

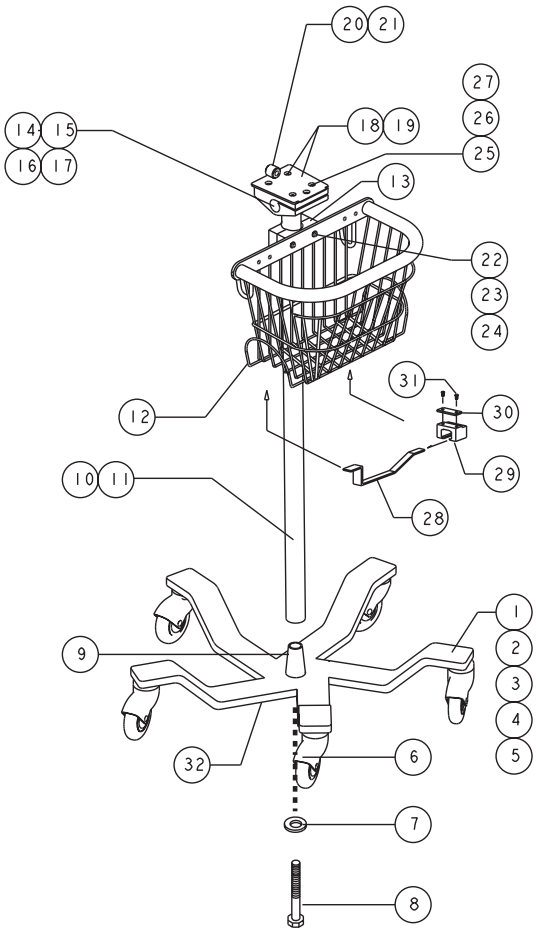
Mobile Stand Kit



5-LEG, 22" DIAMETER LOW CENTER-OF-GRAVITY DETACHABLE BASE, WITH 3" SOFT RUBBER CASTERS, 2 EA. LOCKING. GRAY EPOXY FINISH. DETACHABLE POLE ASSEMBLY WITH GRAY BASKET AND HANDLE, WITH TILT MOUNT, AND WITH DEVICE MOUNTING PLATE.
SHIPPING BOX IS 40.00" X 21.50" X 12.50". SHIPPING WEIGHT IS 31 LBS.

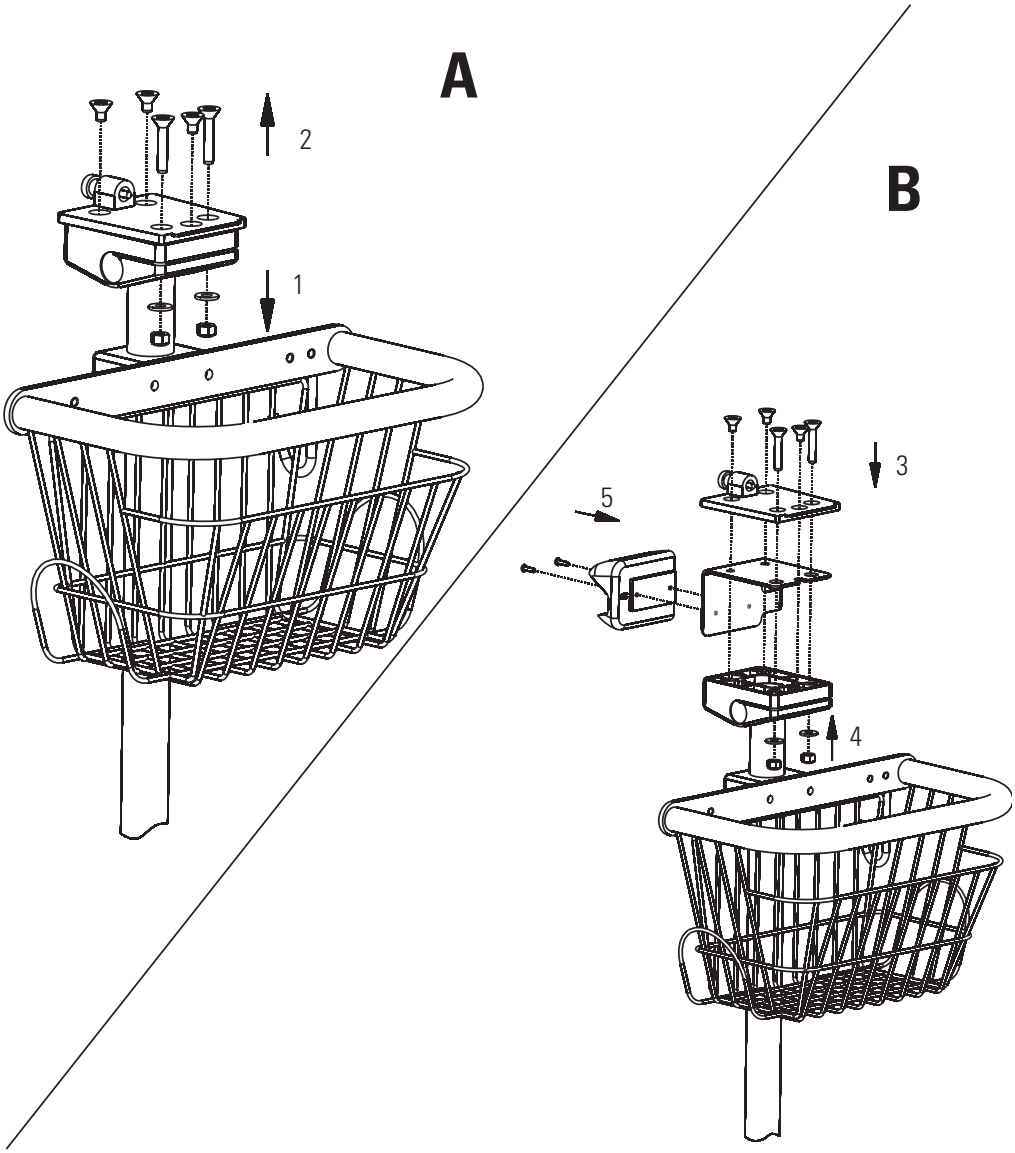
NOTE: ALL DIMENSIONS ARE IN INCHES.

PARTS LIST			
ITEM	DESCRIPTION	QTY	P/N
1	STEEL BASE	1	STL-1005
2	STUD	5	SCR-1258
3	CASTER	3	CAS-1151
4	ESNA NUT	5	SCR-1257
5	WASHER	5	SCR-1341
6	LOCKING CASTER	2	CAS-1163
7	WASHER	1	SCR-1274
8	HEX BOLT	1	SCR-1349
9	TAPERED PIN	1	STL-1032
10	BASE POLE	1	TUB-1268
11	BUSHING	1	PLS-1436
12	BASKET	1	MIS-1574M
13	MOUNT	1SET	PLS-1496
14	TUBE	1	TUB-1202
15	END CAPS	2	MIS-1461
16	SCREW	1	SCR-1567
17	SWIVEL MOUNT	1	PLS-1470
18	SCREWS	3	SCR-1356
19	MOUNT PLATE	1	PLS-1502
20	KNOB	1	KNB-1339
21	RETAINING WASHER	1	SCR-1575
22	SCREW	2	SCR-1295
23	WASHER	2	SCR-1402
24	ACORN NUT	2	SCR-1372
25	SCREW	2	SCR-1559
26	WASHER	2	SCR-1402
27	ESNA NUT	2	SCR-1371
28	AC ADAPTER STRAP	1	STL-1534
29	ADAPTER BLOCK	1	PLS-1497
30	BLOCK CAP	1	STL-1534
31	SCREW	2	SCR-1464
32	MFG LABEL	1	LBL-1526
NOT SHOWN	TAMPER PROOF HEX KEY	1	SCR-1320
	TAMPER PROOF SCREW	1	SCR-1574
PACKAGING	CARTON	1	PAC-1530
	INSERT	1	PAC-1535
	BASE BOX	1	PAC-1536
	BASKET BOX	1	PAC-1537
	STYROFOAM INSERTS	2	PAC-1538
	INSTRUCTION SHEET	1	LBL-1948

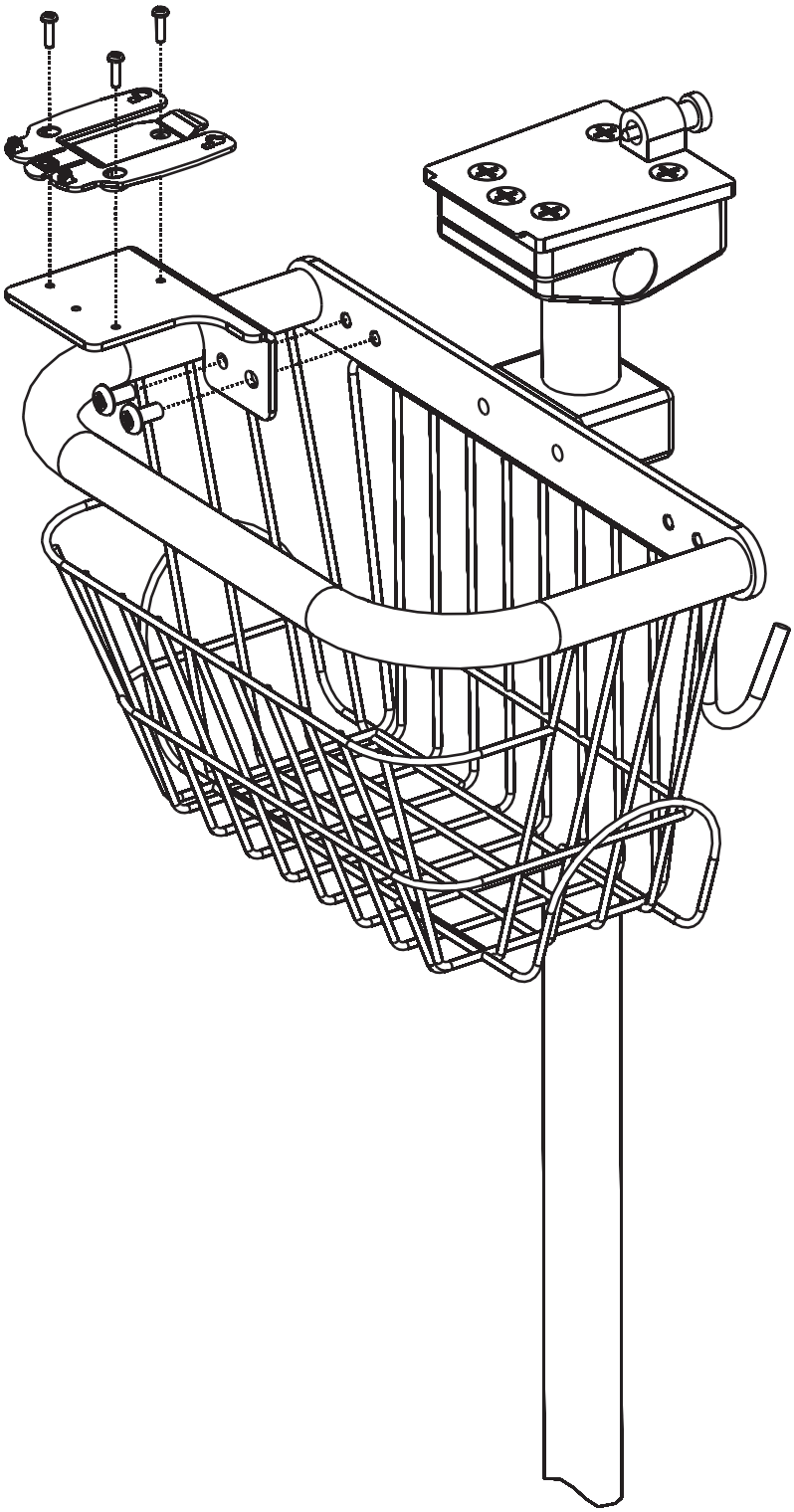


TORQUE ITEM 27 TO 8 - 10 in lbs.
BAG ITEMS 7,8 AND 28 - 31, ALONG WITH TAMPER PROOF KEY AND SCREW.

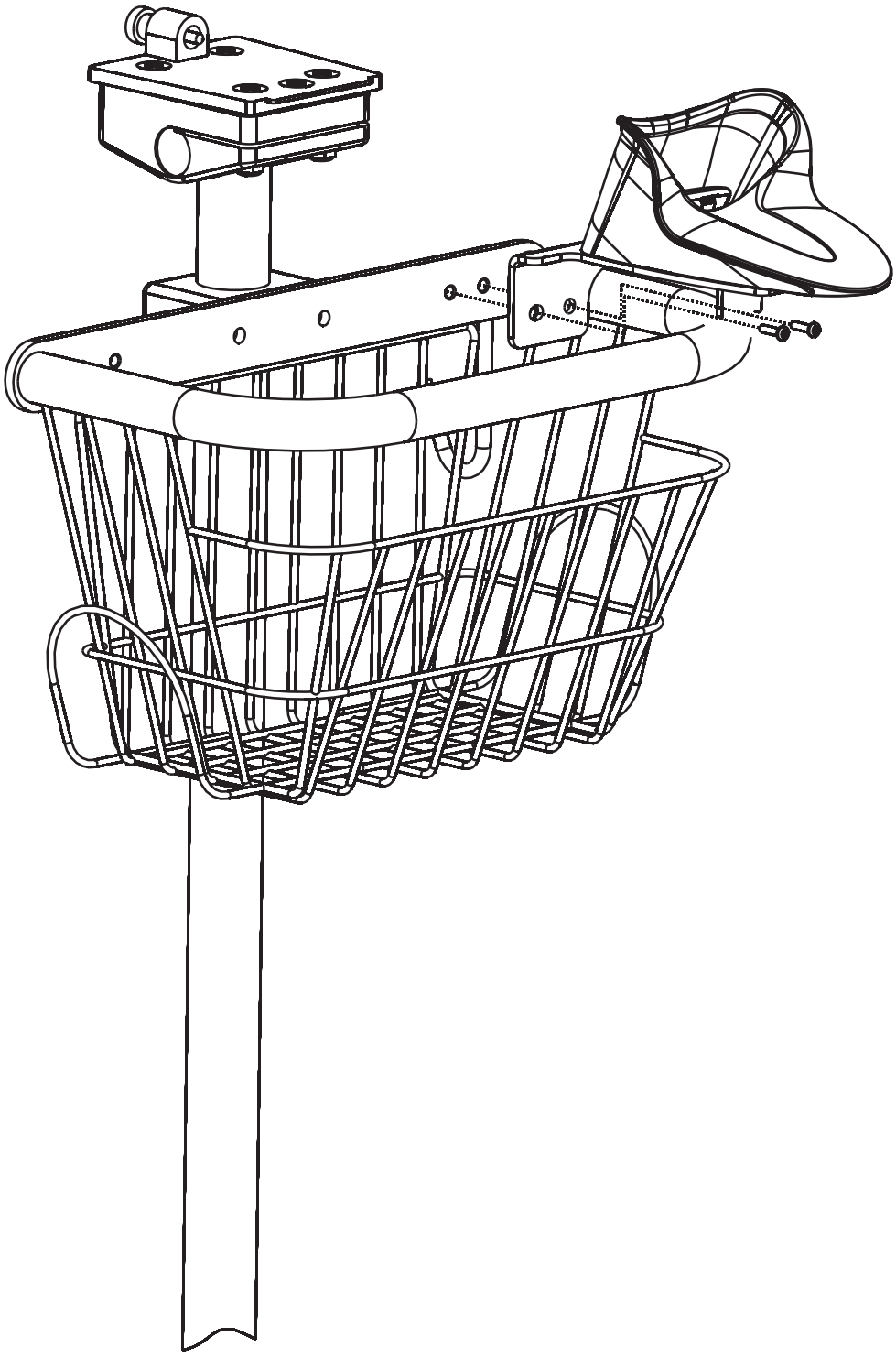
DPAC Mounting Accessory



Printer Mounting Accessory



Scanner Mounting Accessory



Warranty

Spot LXi

Welch Allyn warrants Spot LXi, when new, to be free of defects in material and workmanship and to perform in accordance with manufacturer's specifications for a period of two years from the date of purchase from Welch Allyn or its authorized distributors or agents. The battery is covered by a one-year warranty against original defects in material or workmanship. Welch Allyn will either repair or replace any components found to be defective or at variance from manufacturer's specifications within this time at no cost to the customer. It shall be the purchaser's responsibility to return Spot LXi to Welch Allyn or an authorized distributor, agent, or service representative. This warranty does not include breakage or failure due to tampering, misuse, neglect, accidents, modification, or shipping. This warranty is also void if the instrument is not used in accordance with manufacturer's recommendations or if repaired by other than Welch Allyn or an authorized agent. Purchase date determines warranty requirements. No other express warranty is given.

Remember to submit the instrument registration/warranty card for warranty validation. Complete the information and mail the pre-addressed card to Welch Allyn.

Accessories

The Masimo finger sensor and cable are covered by a six-month warranty against original defects in material or workmanship.

The Nellcor DS-100A is covered by a one-year warranty and the Nellcor DOC-10 cable is covered by a three-month warranty against original defects in material or workmanship.

The Reusable Two-Piece Blood Pressure Cuff is covered by a two-year warranty against original defects in material or workmanship.

The SureTemp Plus probe is covered by a one-year warranty and the SureTemp Plus probe well is covered by a 90-day warranty against original defects in material and workmanship. Probe covers are intended for single-use only.

The Braun ThermoScan PRO 4000 is covered by a three-year warranty against original defects in material or workmanship.

The printer is covered by a one-year warranty against original defects in material or workmanship.

The barcode scanner is covered by a five-year warranty against original defects in material or workmanship.

The wireless radio is covered by a one-year warranty against original defects in material or workmanship.

Welch Allyn®

Advancing Frontline Care™

Material No.704432 Rev.B